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A Guide to the Lacewings (Neuroptera) of Costa Rica

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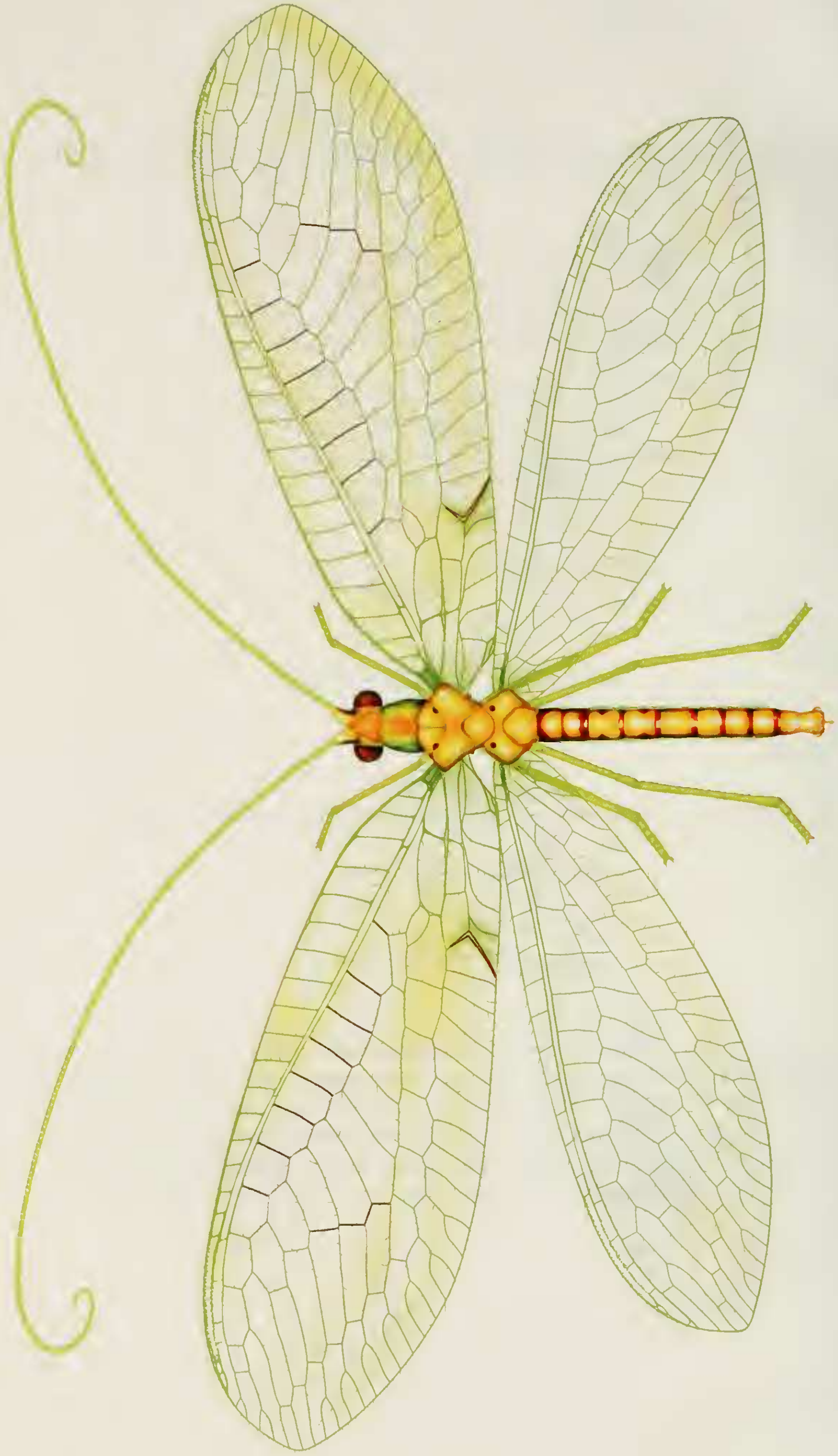
One hundred and eighty-four species of Neuroptera are currently known from Costa Rica. Keys to families, subfamilies, tribes, genera and species are presented. For each species diagnostic characteristics are stated and illustrated. The general geographical distribution, and known Costa Rican collection localities are presented for each species. Information is also given for known elevational ranges, adult flight periods and habitat preferences. One generic and 13 species synonymies are recognized. There are 29 new combinations.



FRONTISPIECE. *Ceraeochrysa elegans* in dorsal view. (Illustration by Victoria Saxe)

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List of Included Taxa

ASCALAPHIDAE

Haplogleniinae

1. *Amoea vacuus* (Gerstaecker, 1893)
2. *Ascalobyas albistigma* (Walker, 1853)
3. *Ascalobyas microcerus* Rambur, 1842
4. *Haploglenius luteus* Walker, 1853
5. *Haploglenius peruvianus* Weele, 1908
6. *Neohaploglenius flavicornis* (McLachlan, 1871)

Ascalaphinae

7. *Ameropterus breviantennis* Penny, 1982
8. *Ameropterus consors* (Gerstaecker, 1893)
9. *Ameropterus mexicanus* (Weele, 1908)
10. *Ameropterus subripiens* (Walker, 1853)
11. *Ameropterus trivialis* (Gerstaecker, 1888)
12. *Cordulecerus inquinatus* Gerstaecker, 1888
13. *Cordulecerus praecellens* (Gerstaecker, 1884)
14. *Cordulecerus subiratus* (Walker, 1853)
15. *Ululodes bicolor* (Banks, 1895)
16. *Ululodes cajennensis* (Fabricius, 1787)
17. *Ululodes macleayanus* (Guilding, 1825)

BEROTHIDAE

18. *Spiroberotha sanctarosae* Adams, 1990

CHRYSOPIDAE

Apochrysinae

19. *Domenechus mirifica* (Gerstaecker, 1888)
20. *Loyola croesus* (Gerstaecker, 1893)

Chrysopinae - Leucochrysini

21. *Berchmansus elegans* (Guérin-Méněville, 1838)
22. *Gonzaga palliceps* (McLachlan, 1867)
23. *Gonzaga torquatus* Navás, 1913
24. *Leucochrysa* (*Leucochrysa*) *adamsi* Penny, 2001
25. *Leucochrysa* (*L.*) *clara* (McLachlan, 1867)
26. *Leucochrysa* (*L.*) *colombia* (Banks, 1910)
27. *Leucochrysa* (*L.*) *lestagei* Navás, 1922
28. *Leucochrysa* (*L.*) *magnifica* (Banks, 1920)
29. *Leucochrysa* (*L.*) *pretiosa* Banks, 1910
30. *Leucochrysa* (*Nodita*) *amazonica* Navás, 1913
31. *Leucochrysa* (*N.*) *amistadensis* Penny, 2001
32. *Leucochrysa* (*N.*) *antica* Navás, 1913
33. *Leucochrysa* (*N.*) *askanes* (Banks, 1946)
34. *Leucochrysa* (*N.*) *caucella* (Banks, 1910)
35. *Leucochrysa* (*N.*) *compar* (Navás, 1921)
36. *Leucochrysa* (*N.*) *cornesta* Banks, 1944
37. *Leucochrysa* (*N.*) *cortesi* Navás, 1913
38. *Leucochrysa* (*N.*) *duarte* Banks, 1946
39. *Leucochrysa* (*N.*) *egregia* Navás, 1913
40. *Leucochrysa* (*N.*) *forcipata* Penny, 1998
41. *Leucochrysa* (*N.*) *indiga* (Navás, 1928)
42. *Leucochrysa* (*N.*) *laertes* (Banks, 1946)
43. *Leucochrysa* (*N.*) *lancala* Banks, 1944
44. *Leucochrysa* (*N.*) *lenora* (Banks, 1944)
45. *Leucochrysa* (*N.*) *navasi* Kimmins, 1940
46. *Leucochrysa* (*N.*) *nigrovaria* (Walker, 1853)
47. *Leucochrysa* (*N.*) *oenops* Adams, 1987
48. *Leucochrysa* (*N.*) *pallescens* Banks, 1946
49. *Leucochrysa* (*N.*) *postica* Navás, 1913
50. *Leucochrysa* (*N.*) *ratcliffei* Penny, 2000
51. *Leucochrysa* (*N.*) *serrei* (Navás, 1923)
52. *Leucochrysa* (*N.*) *superior* Navás, 1913
53. *Leucochrysa* (*N.*) *virginiae* Penny, 1998
54. *Vieira leschnaulti* (Navás, 1911)

Chrysopinae - Belonopterygini

55. *Nacarina cordillera* (Banks, 1910)
56. *Nacarina megaptera* (Navás, 1927)
57. *Nacarina titan* Banks, 1915

Chrysopinae - Chrysopini

58. *Ceraeochrysa acmon* Penny, 1998
59. *Ceraeochrysa arioles* (Banks, 1944)
60. *Ceraeochrysa berlandi* (Navás, 1924)
61. *Ceraeochrysa caligata* (Banks, 1946)
62. *Ceraeochrysa cincta* (Schneider, 1851)
63. *Ceraeochrysa claveri* (Navás, 1911)
64. *Ceraeochrysa costaricensis* Penny, 1997
65. *Ceraeochrysa cubana* (Hagen, 1861)
66. *Ceraeochrysa defreitasi* Penny, n.sp.
67. *Ceraeochrysa discolor* (Navás, 1914)
68. *Ceraeochrysa elegans* Penny, 1998
69. *Ceraeochrysa everes* (Banks, 1920)
70. *Ceraeochrysa gradata* (Navás, 1913)
71. *Ceraeochrysa inbio* Penny, 1997
72. *Ceraeochrysa nigripedis* Penny, 1997
73. *Ceraeochrysa pseudovaricosa* Penny, 1998
74. *Ceraeochrysa sanchezi* (Navás, 1924)
75. *Ceraeochrysa smithi* (Navás, 1914)
76. *Ceraeochrysa tauberae* Penny, 1997
77. *Ceraeochrysa valida* (Banks, 1895)
78. *Chrysoperla exotera* (Navás, 1913)
79. *Chrysoperla externa* (Hagen, 1861)
80. *Chrysopodes* (*Chrysopodes*) *costalis* (Schneider, 1851)
81. *Chrysopodes* (*C.*) *nevermanni* Navás, 1928
82. *Chrysopodes* (*C.*) *varicosa* Navás, 1914

83. *Chrysopodes (C.) victoriae* Penny, 1998
84. *Chrysopodes (Neosuarius) collaris* (Schneider, 1851)
85. *Chrysopodes (N.) crassinervis* Penny, 1998
86. *Chrysopodes (N.) crassipennis* Penny, 2000
87. *Chrysopodes (N.) oswaldi* Penny, n.sp.
88. *Meleoma poolei* Adams, 1969
89. *Meleoma titschaki* Navás, 1928
90. *Plesiochrysa brasiliensis* (Schneider, 1851)
91. *Plesiochrysa elongata* (Navás, 1913)
92. *Ungla pallescens* Penny, 1998

CONIOPTERYGIDAE

Aleuropteryginae

93. *Aleuropteryx clavicornis* Meinander, 1995
94. *Aleuropteryx rugosa* Meinander, 1995
95. *Neoconis dentata* Meinander, 1972
96. *Neoconis marginata* Meinander, 1972

Coniopteryginae

97. *Coniopteryx (Xeroconiopteryx) falcata* Meinander, 1995
98. *Coniopteryx (Scotoconiopteryx) cyphodera* Johnson, 1978
99. *Coniopteryx (S.) flinti* Meinander, 1975
100. *Coniopteryx (S.) fumata* Enderlein, 1907
101. *Coniopteryx (S.) fumicolor* Meinander, 1972
102. *Coniopteryx (S.) isthmicola* Meinander, 1972
103. *Coniopteryx (S.) panamensis* Meinander, 1974
104. *Coniopteryx (Coniopteryx) californica* Meinander, 1974
105. *Coniopteryx (C.) freytagorum* Johnson, 1978
106. *Coniopteryx (C.) mexicana* Meinander, 1974
107. *Semidalis arnaudi* Meinander, 1972
108. *Semidalis manausensis* Meinander, 1980
109. *Semidalis mexicana* Meinander, 1972
110. *Semidalis panamensis* Meinander, 1974
111. *Semidalis rondoniensis* Meinander, 1982
112. *Semidalis soleri* Monserrat, 1985

DILARIDAE

113. *Nallachius americanus* (McLachlan, 1880)
114. *Nallachius parkeri* Penny, 1994
115. *Nallachius pulchellus* Banks, 1938

HEMEROBIIDAE

116. *Hemerobius bolivari* Banks, 1910
117. *Hemerobius discretus* Navás, 1917
118. *Hemerobius edui* Monserrat, 1991
119. *Hemerobius gaitoi* Monserrat, 1996
120. *Hemerobius hernandezi* Monserrat, 1996
121. *Hemerobius hirsuticornis* Monserrat, 1999
122. *Hemerobius jucundus* Navás, 1927
123. *Hemerobius martinezae* Monserrat, 1996
124. *Hemerobius nigridorsus* Monserrat, 1996
125. *Hemerobius pennii* Monserrat, 1996
126. *Hemerobius withycombei* (Kimmins, 1928)
127. *Megalomus minor* Banks, 1905
128. *Megalomus pictus* Hagen, 1861
129. *Micromus subanticus* (Walker, 1853)
130. *Notiobiella mexicana* Banks, 1913
131. *Notiobiella rubrostigma* Navás, 1914
132. *Nusalala brachytera* Oswald, 1996
133. *Nusalala championi* Kimmins, 1937
134. *Nusalala colombiensis* (Banks, 1910)
135. *Nusalala ghioi* Monserrat, 2000
136. *Nusalala irrebita* (Navás, 1929)
137. *Nusalala tessellata* (Gerstaecker, 1888)
138. *Nusalala uncata* Kimmins, 1937
139. *Nusalala unguicaudata* Monserrat, 2000
140. *Sympherobius angustus* (Banks, 1904)
141. *Sympherobius arizonicus* Banks, 1911
142. *Sympherobius similis* Carpenter, 1940
143. *Sympherobius subcostalis* Monserrat, 1998

MANTISPIDAE

Calomantispinae

144. *Nolima infensus* Navás, 1924

Mantispinae

145. *Buyda phthisica* (Gerstaecker, 1885)
146. *Climaciella brunnea* (Say, 1824)
147. *Climaciella obtusa* Hoffman, n.sp.
148. *Climaciella porosa* Hoffman, n.sp.
149. *Dicromantispa debilis* (Gerstaecker, 1888)
150. *Dicromantispa gracilis* (Erichson, 1839)
151. *Dicromantispa sayi* (Banks, 1897)
152. *Dicromantispa synapsis* Hoffman, n.sp.
153. *Entanoneura batesella* (Westwood, 1867)
154. *Haematomantispa nubeculosa* (Navás, 1933)
155. *Leptomantispa chaos* Hoffman, n.sp.
156. *Leptomantispa nymphe* Hoffman, n.sp.
157. *Leptomantispa pulchella* (Banks, 1912)
158. *Zeugomantispa compellens* (Walker, 1860)
159. *Zeugomantispa minuta* (Fabricius, 1775)
160. *Zeugomantispa viridula* (Erichson, 1839)

Symphrasinae

161. *Plega hagenella* (Westwood, 1867)
162. *Trichoscelia remipes* (Gerstaecker, 1888)

MYRMELEONTIDAE

Myrmeleontinae - Acanthaclisini

163. *Vella fallax* (Rambur, 1842)

Myrmeleontinae – Brachynemurini

164. *Dejuna fenestrata* (Banks, 1913)
165. *Dejuna mimica* (Stange, 1970)
166. *Dejuna setosa* (Stange, 1970)

Myrmeleontinae - Myrmeleontini

167. *Myrmeleon* (*Nehornius*) *perspicuus* Gerstaecker, 1893
168. *Myrmeleon timidus* Gerstaecker, 1888
169. *Myrmeleon uniformis* Navás, 1920

Myrmeleontinae - Nemoleontini

170. *Dimarella angusta* (Banks, 1908)
171. *Dimarella garciai* (Navás, 1932)
172. *Dimarella mixteca* Miller, 1989
173. *Elachyleon punctipennis* Esben-Petersen, 1927
174. *Eremoleon dunklei* Stange, 1999
175. *Eremoleon genini* (Navás, 1924)
176. *Glenurus heteropteryx* Gerstaecker, 1885
177. *Glenurus luniger* Gerstaecker, 1893
178. *Glenurus proi* Navás, 1929
179. *Purenleon abruptus* Stange, n.sp.
180. *Purenleon debilis* (Gerstaecker, 1893)
181. *Purenleon iniquus* (Navás, 1914)
182. *Purenleon parallelus* (Banks, 1935)

POLYSTOECHOTIDAE

183. *Polystoechotes punctatus* (Fabricius, 1787)

SISYRIDAE

184. *Sisyra apicalis* Banks, 1908

INCLUDED NEW SYNONYMIES

Note: New synonymies are indicated in the body of the text with **bold face** type.

GENUS
Diazus Navás, 1914 = *Purenleon* Stange, new name

SPECIES
Haploglenius angulatus Gerstaecker, 1894 = *Neohaploglenius flavicornis* (McLachlan, 1871)
Leucochrysa luctuosa Banks, 1914 = *Leucochrysa* (*Nodita*) *egregia* Navás, 1913
Chrysopa ceratica Navás, 1911 = *Leucochrysa* (*Nodita*) *nigrovaria* (Walker, 1853)
Nodita maculata Navás, 1928 = *Leucochrysa* (*Nodita*) *nigrovaria* (Walker, 1853)
Chrysopa indicata Navás, 1914 = *Ceraeochrysa gradata* (Navás, 1913)
Chrysopa infausta Banks, 1946 = *Ceraeochrysa gradata* (Navás, 1913)
Mantispa limbata Gerstaecker, 1885 = *Entanoneura batesella* (Westwood, 1867)
Mantispilla flavicornis Navás, 1930 = *Zeugomantispa minuta* (Fabricius, 1775)
Mantispilla rubricata Navás, 1924 = *Zeugomantispa minuta* (Fabricius, 1775)
Mantispilla viridata Navás, 1924 = *Zeugomantispa minuta* (Fabricius, 1775)
Mantispa viridis Walker, 1853 = *Zeugomantispa minuta* (Fabricius, 1775)
Myrmeleon leptaleus Navás, 1924 = *Myrmeleon uniformis* Navás, 1920
Elachyleon punctipennis pulchellus Esben-Petersen, 1933 = *El. punctipennis* Esben-Petersen, 1927

INCLUDED NEW TAXONOMIC COMBININATIONS

Note: New taxonomic combinations are indicated in **bold face** type in the text.

Chrysopidae
Gonzaga palliceps (McLachlan, 1867)
Leucochrysa (*Nodita*) *duarte* (Banks, 1946)
Mantispidae
Buyda phthisica (Gerstaecker, 1885)
Dicromantispa debilis (Gerstaecker, 1888)
Dicromantispa gracilis (Erichson, 1839)
Dicromantispa sayi (Banks, 1897)
Entanoneura batesella (Westwood, 1867)
Haematomantispa nubeculosa (Navás, 1933)
Leptomantispa pulchella (Banks, 1912)
Zeugomantispa compellens (Walker, 1860)
Zeugomantispa minuta (Fabricius, 1775)
Zeugomantispa viridula (Erichson, 1839)
Myrmeleontidae
Dejuna fenestrata (Banks, 1913)
Dejuna mimica (Stange, 1970)
Dejuna setosa (Stange, 1970)
Purenleon albovaria (Banks, 1942)
Purenleon bistictus (Hagen, 1861)
Purenleon clavatus (Navás, 1914)
Purenleon connexus (Banks, 1920)

Purenleon cubensis (Alayo, 1968)
Purenleon debilis (Gerstaecker, 1894)
Purenleon imbellus (Banks, 1941)
Purenleon iniquus (Navás, 1914)
Purenleon inscriptus (Hagen, 1861)
Purenleon minor Banks, 1927
Purenleon nubipennis (Navás, 1917)
Purenleon parallelus Banks, 1935
Purenleon reductus Banks, 1941
Purenleon zayasi Alayo, 1968

PREFACE

Biologists and administrators in Costa Rica are in the midst of an exciting project to inventory the biological diversity of their country. This is not an easily achievable mission. It will require the combined efforts of hundreds, perhaps thousands, of taxonomists from many disparate disciplines willing to devote their time and energy to supporting this task. At this time we do not know if all groups of plants and animals will ever be completely documented, and if so, how long it will take. However, in order to accomplish a complete inventory within a reasonable time frame, each group of specialists must proceed with the idea in mind that they are providing a small portion of that information. The California Academy of Sciences, through its cadre of biologists and scientific publication system, is proud to support this ambitious goal. The following publication is the result of one of these efforts. It is hoped that this work will provide the stimulus for more monographs on the fauna and flora of Costa Rica, as well as lay the foundation for further studies of Neuroptera in the region.

Until recently the term Neuroptera was applied collectively to a group of insects that are now generally recognized as three orders: Raphidioptera (snakeflies), Megaloptera (dobsonflies and fishflies), and Neuroptera in a more restricted sense (lacewings, antlions, owlflies, dustywings, and their allies). This monograph treats Neuroptera only in the more restricted definition.

INTRODUCTION

From the first Spanish explorers to most recent biologists, Costa Rica has continued to impress people as a "costa rica," or rich coast. For biologists and tourists alike, the country's plants and animals are amazing for their diversity as well as their colorful and bizarre forms. From the iridescent Resplendent Quetzal (*Pharomachrus mocinno*) and Turquoise Cotingas (*Cotinga ridgwayi*) to brilliant Poison-Arrow Frogs (*Dendrobates* spp.) and Golden Toads (*Bufo periglenes*), from metallic blue *Morpho* spp. butterflies and golden yellow *Chrysina resplendens* scarab beetles to large pink *Cattleya skinneri* orchids, bright coral reef fishes and brilliantly colored sea slugs, it is amazing that a country so small (only 51,054 sq. km, see Map 1, 2) can contain so many biological wonders. Costa Rica, the size of West Virginia, has 820 bird species (more than all of North America). There are 1100 species of orchids (Walter 1983). The number of butterfly species (543) is much greater than that of all of Britain and Europe (338) (Higgins and Riley 1970). The number of species of butterflies is also equal or greater than that of some well-studied tropical countries, such as Malaysia, Liberia, and Panama (DeVries 1986). This biodiversity extends also to the Neuroptera. When the present study was initiated, only 40 species were known in the literature from Costa Rica. Now, we know of 184 species and there are almost certainly additional species that we have not yet seen. This compares favorably with the 243 species known from all of Europe, or the 200+ species known from the lowland Amazon Basin.

BIOGEOGRAPHY

The Neuroptera fauna of Costa Rica display several distinctive distributional patterns that reflect climatic/floristic zones. **Guanacaste Distribution**. Guanacaste Province is a relatively dry climatic zone where a number of species reach their southern limits, or are endemic to the area. These include such species as *Notiobiella mexicana* Banks and *Spiroberotha sanctarosae* Adams.

A second pattern is a **Pacific Coastal Distribution**, with species found all along the Pacific lowlands and central valley, but not on the Caribbean slopes or lowlands. Species displaying this distribution include *Micromus subanticus* and *Vella fallax.*

A third group of species is found in the **Caribbean lowlands**, usually also distributed into northern Heredia Province. Species that show this pattern are frequently present further south in Panama and South America, but not further north. Some examples are *Buyda phthisica* and *Leucochrysa* (*Leucochrysa*) *pretiosa.*

A fourth pattern is a **mid- to high-elevational Distribution** along the high central mountains. These species are also typically found in South America and reach their northern limit in Central America. *Hemerobius bolivari* is an example of this type of distribution, being found from central Chile to Guatemala. The reverse of this pattern is found in *Polystoechotes punctatus.* It ranges from Canada and northern U.S.A., south through the mountainous areas of western U.S.A. and Mexico to Costa Rica and northern Panama.

A further element may be the **endemic fauna**. These include the already mentioned lowland species in Guanacaste Province, and several upland species in various mountain ranges. There are many species included in this monograph which at this time are known only from Costa Rica. However, because this country is much better studied than some neighboring countries, it may be premature to call any Neuroptera species endemic to Costa Rica until further collecting is done.

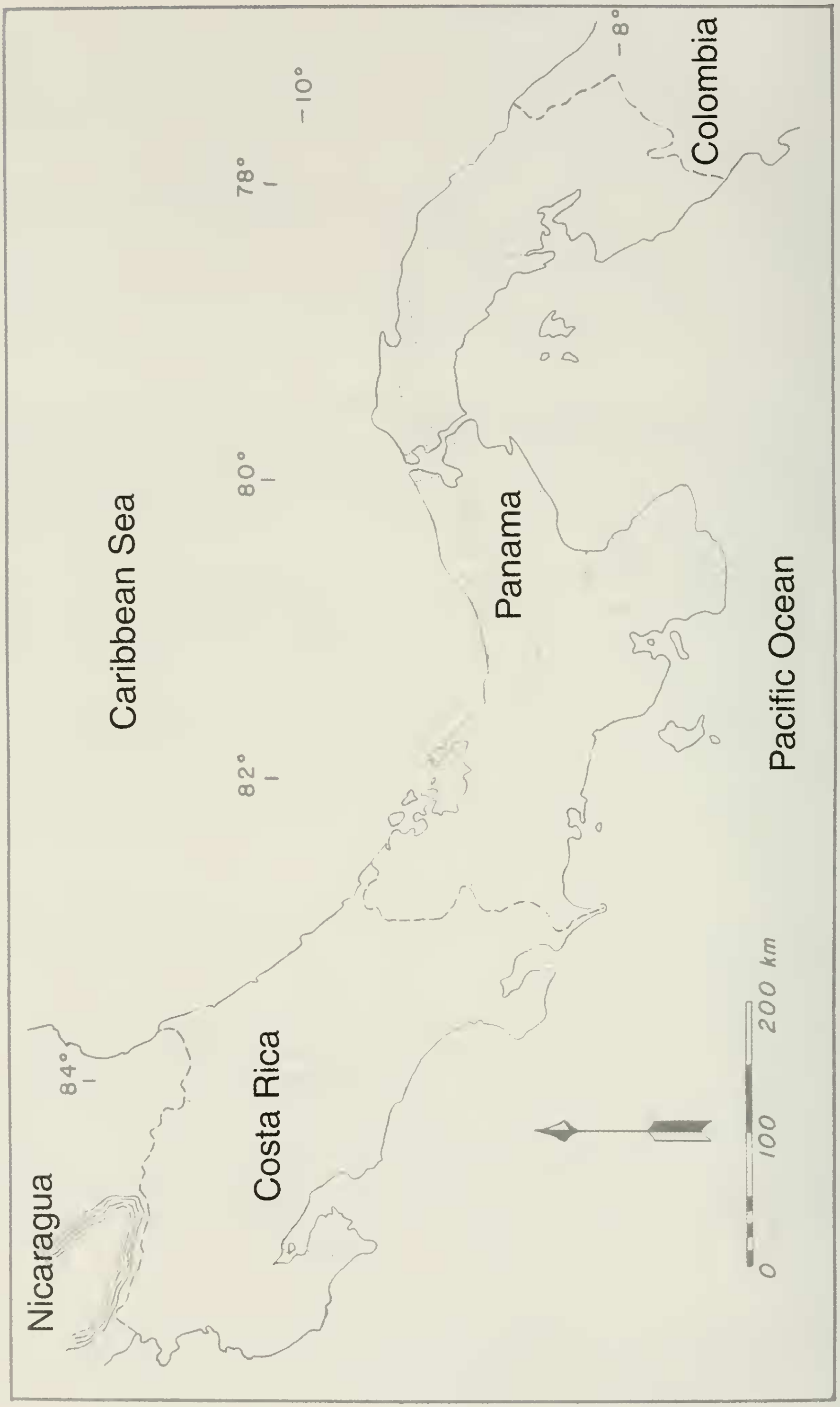
In Guanacaste Province several species of Hemerobiidae known from further north can be found at low elevations, such as *Micromus subanticus* and *Megalomus minor*. However, in the central and southern parts of Costa Rica, hemerobiids have not yet been found at low elevations. At mid-elevations (1300–1600 m), such as Monteverde and Las Alturas, the dominant species appears to be the South American *Hemerobius bolivari.*

Many species are found extensively throughout North and Central America, and the land forms of Costa Rica appear not to have formed permanent barriers to movement of these species. Such species include the strong-flying owlfly *Ululodes macleayanus*, as well as smaller ubiquitous species common to agricultural habitats, like *Chrysoperla externa*, or forest edge habitats, like *Megalomus minor, Mantispa viridula* and *Climaciella brunnea.*

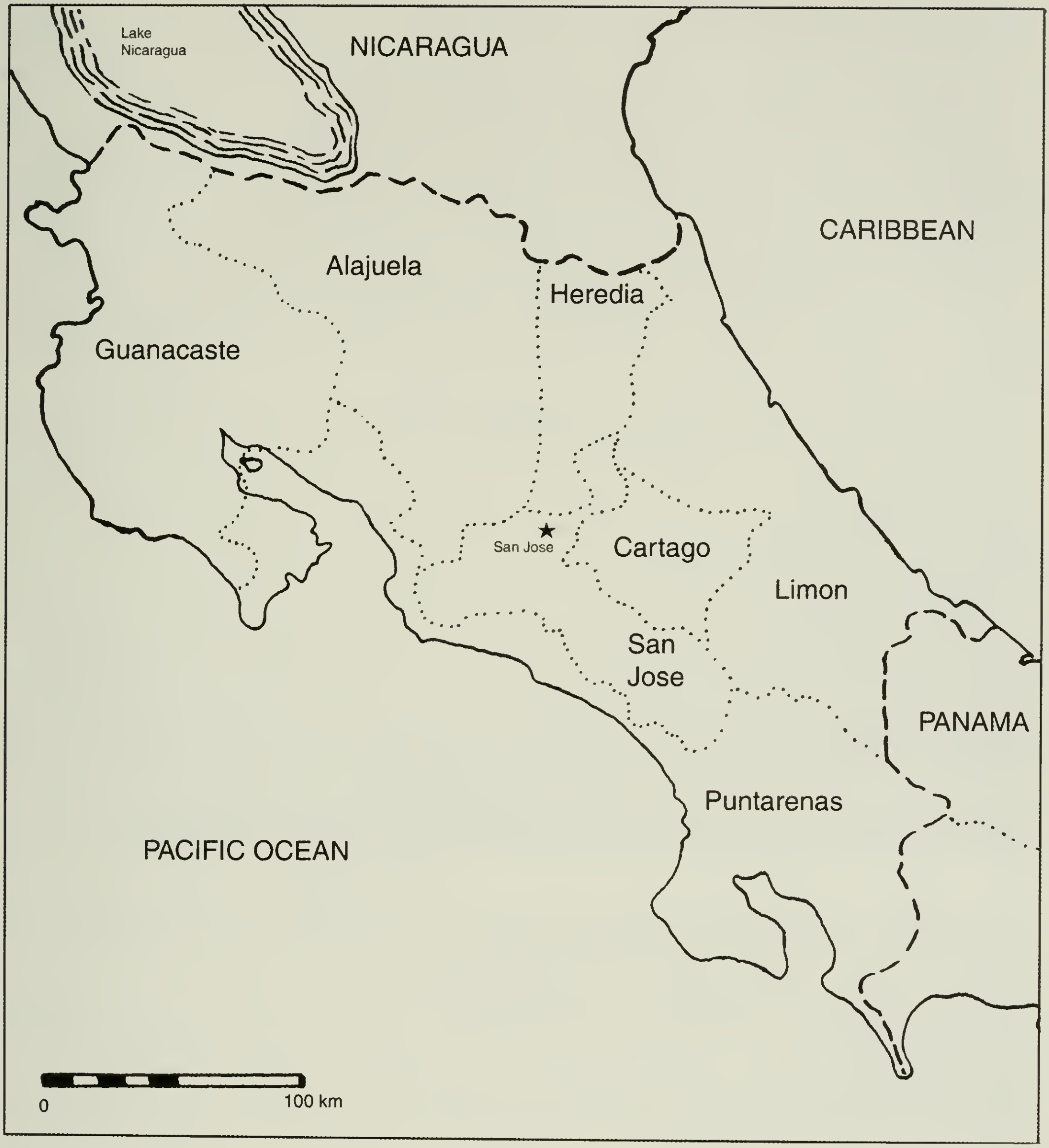
Finally, a note of caution should be exercised when looking at geographical distributions of Neuroptera, both within Costa Rica and regionally. Many of these insects are small and not often collected using commonly utilized trapping techniques. Their currently recognized distributions are not yet well known and many may be far more extensive than presently known. Some species known from a few widely separated collection sites may eventually be found throughout Central America. We are fortunate in having so many recent records from Costa Rica. The data presented herein will give some guidance as to distribution, but habitat and elevational data may also provide help in finding these species in other parts of the country, and in neighboring countries, where they have not yet been collected.

SCOPE OF THIS MANUAL

Inclusions: This manual is not meant to be a definitive monograph of the Neuroptera fauna of Costa Rica. Rather, it is meant to provide guidance in identifying species within this fauna, as an aid to further studies of biology, ecology, and pest management. Although coniopterygids and some chrysopids and hemerobiids cannot be identified without using male genitalia, most neuropterans in



Map 1. Map of southern Central America.



Map 2. Map of Costa Rica.

Costa Rica can be identified using non-genitalic characters such as wing venation and head markings. However, this manual must be used with caution, as there are almost certainly some species in Costa Rica which have not yet been collected or described. If there is any doubt about the identity of a species, consultation of appropriate specialists or more detailed literature is recommended.

Exclusions: The authors have only treated the fauna based on adult material, except in the Myrmeleontidae. Kady and Maurice Tauber (Cornell University, Ithaca, New York, U.S.A.) have reared many larval chrysopids from Costa Rica and Sergio de Freitas (Universidade Estadual de São Paulo, Jaboticabal, Brazil) has done similar work in São Paulo State, Brazil. We encourage them and others to continue to provide insights into the larval stages of the Costa Rican neuropteran fauna.

Non-Costa Rican Families. The authors have examined thousands of specimens for the current work and have documented the diversity of Neuroptera within Costa Rica as completely as is possible at the present time. Three other New World families may eventually be found within the country. They are:

Ithonidae. Until recently this family was only known from Australia, the high mountains of southeast Asia, Mexico and the deserts of southwestern U.S.A. However, Penny (1996) described a new genus and species of ithonid from the high mountains of northern Honduras. Males of the Honduras species are weak fliers and females are flightless, making dispersal difficult. Because high altitude populations generally are localized and inaccessible, they are seldom adequately sampled and it is possible that members of Ithonidae may subsequently be found in the higher mountainous regions of Costa Rica.

Nemopteridae. In the New World this family was known for many years from two species of Crocinae in Argentina and one species of Nemopterinae in Chile. Knowledge of their geographical distribution was expanded when Stange and Williner (1981) found a species of Crocinae in Bolivia, and again when Mansell (1983) encountered a new genus of Crocinae in southern Peru. Subsequently, Miller and Stange (1989b) have collected the genus described by Mansell along the Caribbean coast of Venezuela. Finding Nemopteridae so far north was very unexpected, and has fueled much speculation as to the actual distribution of nemopterids in the Neotropics. Crocinae are relatively small and transparent-winged, and most are cave-dwellers. Almost all specimens are picked up by a few specialists who recognize this subfamily and know where to look for them, most often rearing them from larvae.

Osmylidae. In the Western Hemisphere osmylids are known only from South America. This family is frequently collected in the Andes of Chile and species of *Isostenosmylus* and *Gumilla* are found in the mountains of Santa Catarina State in southern Brazil. North of Chile they have been less frequently collected in the Andes as far north as Ecuador. Larvae most often live in mosses along the margins of mountain streams. There appears to be no barrier to their dispersal along the Andes into Colombia, although they have never been recorded from that country. The question remains as to whether the backbone of mountains into Central America is high enough and has been continuous enough over geological time to allow survival of osmylids in Costa Rica.

ABUNDANCE

Perhaps no feature of the Costa Rican Neuroptera fauna is so striking as the relatively large number of species which are seldom collected. Despite having wide geographical distributions and appearing to be present in the adult stage during most, if not all of the year, these species have eluded the best efforts of researchers and parataxonomists alike to capture them. For example, the very large and unusual dark-pigmented green lacewing, *Loyola croesus*, which is found from southern Mexico to Peru has only been collected in Costa Rica three times. Relatively few species can be collected with regularity and predictability. Only by gaining a much better knowledge of individual species' life histories can we begin to understand the role that these predators play in the Costa Rican ecosystem. It is hoped that the present monograph will create a foundation that students can use to undertake the studies needed to better understand this role.

COLLECTING AND DISTRIBUTION OF NEUROPTERA

Two methods have proven most effective for collecting Neuroptera—beating vegetation with a sweep net and light trapping. Two additional methods that have also been moderately effective—flight intercept traps (such as Malaise traps) and molasses bait traps (for Chrysopidae).

Three families of Neuroptera are taken regularly by beating vegetation: Coniopterygidae, Hemerobiidae, and Chrysopidae. Coniopterygidae are usually found in dense forest vegetation low to the ground. They are generally found in the 0–1 m height range. Occasionally, however, they are found in more open, sunny habitats.

Coniopterygidae are most active, and most easily seen, very early in the morning (about 6:00 to 8:00 a.m.). At that time they frequently can be seen fluttering across forest trails, or hovering near dense vegetation. In the early morning the white powder of their wings shows clearly in flight against the dark forest backdrop.

Hemerobiidae can be taken by beating tree branches at about 2 to 3 m height in primary forests. They are difficult to see because of their small size and pale brown coloration. When fluttering to neighboring branches, they resemble small moths that frequent the same habitat. They often prefer resting on dark brown surfaces, such as dead leaves, vines, or tree trunks, although they are also often found under green leaves. Often when a branch is beaten, brown lacewings will not fly at all, but rather drop to the forest floor and lie quiescent for several seconds. As tropical forest leaves often bear a heavy load of debris, rapping on a branch will send a shower of debris cascading to the forest floor, and hemerobiids generally go unseen with this debris when feigning death. When specifically looking for Hemerobiidae, it is best to use a beating sheet, or to hold a collecting net open below the branch and then carefully look through the debris for individual brown lacewing specimens.

Hemerobiidae have also been taken effectively with light traps at low elevations in Guanacaste Province and at mid-elevations in Escazú and San Vito. The highest elevation recorded for Hemerobiidae in Costa Rica is a specimen of *Hemerobius bolivari* from 2360 m elevation in Zona Protectora Las Tablas, near Cerro Echandi.

Chrysopidae appear to have a somewhat narrower elevational range than Hemerobiidae, being found from sea level to ca. 1900 m. Leucochrysine green lacewings are usually collected in the same way as brown lacewings, by beating understory branches at 2–3 m height. Leucochrysini have less of a tendency to feign death, and more frequently are seen fluttering to nearby branches. They seem to prefer woody dicot understory saplings. Best results have been obtained by beating young trees near streams in primary forest, where humidity is high and light intensity low. The only Chrysopini found in primary forest have been *Chrysopodes* species. Although no habitat information is available for Costa Rican Apochrysini, in other parts of the Neotropics (Brazil) and Papua New Guinea this tribe has only been taken in primary forest. Chrysopini can often be taken in large numbers in open pastures or grasslands. The dominant species appears to be *Chrysoperla externa,* which, as adults, feed on grass pollen. This species can be found even in isolated pastures deep in forest with few or no grasses, indicating excellent powers of dispersal.

Fewer species of Chrysopidae and Hemerobiidae seem to be found in young secondary forest, although *Chrysopodes* seems to do well in such habitats.

An effective method for collecting most groups of Chrysopidae is light trapping. Both mercury vapor and ultra-violet lights, as well as ordinary fluorescent and incandescent bulbs attract some specimens of Chrysopidae. One of only three known specimens of Costa Rican *Loyola croesus* was attracted to lights (Luis Diego Gomez, personal communication). However, chrysopids have at times been seen flying past bright lights at night, with little apparent attraction. When attracted to lights, they often prefer to rest on the undersurfaces of overhanging nearby objects, such as eaves of buildings and leaves of nearby trees.

Other groups of Neuroptera, such as Ascalaphidae, Myrmeleontidae, Berothidae, and Mantispidae are most frequently collected with light traps.

Berothidae are apparently restricted to Guanacaste Province and emerge during the driest part of the year, from December to March.

Mantispidae are common in forested and forest-edge areas of Costa Rica, and can occasionally be collected with a net. However, they seem to be collected most frequently at lights. The exception to this is the wasp-mimicing species, *Climaciella brunnea*, which is seen most often in open meadows and pastures on clumps of flowers, such as umbels and composites. They imitate wasps very closely (Opler 1981), and make no attempt to flee quickly or hide. In the United States, this species often has short-duration mass emergences, where many individuals will be seen on numerous flowers in an area, only to disappear completely a week later (Jean Laffoon, personal communication). Mantispidae are most abundant in lowland areas of Costa Rica and have not been collected above 1500 m. *Buyda phthisica* and a closely-related new species from Panama have been taken only in lowlands on the Caribbean side of the central mountain ranges.

Sisyridae should be found in many parts of Costa Rica along the margins of streams where freshwater sponges are found, but have to date only been collected once within the country, at a light trap near Cañas in Guanacaste Province.

Ascalaphidae are active at dusk, skimming over the soil surface in open areas and among the tree top canopies in forests. They are difficult to see in failing light, and even harder to catch. They are very strong fliers, quickly pursuing small flying insects at twilight. They sometimes hit sheets and other barriers at light traps in their pursuit of insects attracted to the lights. Some species of owlflies in the southwestern U.S.A. (for example, *Ululodes arizonensis* Banks) do not seem to respond to the light itself, and if not captured quickly, will hit the light sheet while pursuing insects, reorient themselves in moments, and quickly fly away. Other species in northern Brazil (for example, *Ameropterus delicatulus* (McLachlan)) appear to be strongly attracted to lights and will stay at a light for hours.

The Haplogleniinae appear to be forest dwellers, while most Ascalaphinae are found in more open situations. Larval Haplogleniinae occasionally can be seen waiting motionlessly on understory vegetation. They are extremely flattened and appear very similar to the fungal growths that often spot tropical leaves. It is suspected that these larvae have multi-year life cycles. Haplogleniine adults occasionally can be seen resting singlely on low vegetation in the forest with their wings open. Larvae of Ascalaphinae rest on the soil surface and blend in so well with their substrate that they are seldom seen. Adult Ascalaphinae rest during the day on twigs with their wings folded along the branch so that they are only seen infrequently. The ascalaphine genus *Cordulecerus* is an exception, being collected most often in the forest, where they are sometimes found aggregating in large clusters, especially near streams (Hogue and Penny 1989).

Myrmeleontidae is the most speciose family of Neuroptera in the world, but its species prefer drier areas of the world, and are not very diverse in Costa Rica. The greatest diversity of Myrmeleontidae in the country appears to be in the drier Guanacaste Province. In Costa Rica, only larvae of the genus *Myrmeleon* make funnels, which are ubiquitous under buildings and bridges throughout the country below 1500 m elevation. Other genera have larvae which live on the soil surface, just under the soil surface, on ceilings of caves, in tree holes, or in rock crevices. Forest-dwelling species, such as *Eremoleon* spp., are not as well known as species that frequent open dry areas, and we may eventually find a rich, but rarely encountered, forest fauna of ant-lions. Although many individuals of forest-dwelling species may be present in any lowland area of the country, they are seldom seen except at light traps. Although the funnels of *Myrmeleon* larvae are very common, the adults are more rarely encountered.

Dilaridae is another family whose members are almost never seen without using light traps. In the United States, larvae have been found in rotting tree trunks, feeding on wood-dwelling insects. A study in a Brazilian Amazon forest (Penny and Arias 1981) found adults far more actively attracted to lights in the forest canopy than at ground level, and adults appeared to be most abundant during the driest period of the year.

Individuals of Polystoechotidae are seldom encountered in Costa Rica. They have been collected at mid-elevations at Monteverde and Cartago. In the United States *Polystoechotes punctatus* is known to fly at very low temperatures (5° C) and is strongly attracted to smoke. Many have been collected around camp fires. Polystoechotids are also taken at lights in remote areas. Their geographical range appears to be shrinking dramatically, perhaps in response to lights in developed areas.

SYSTEMATIC TREATMENT

KEY TO FAMILIES OF COSTA RICAN NEUROPTERA
(after Henry et al. 1991)

1. Forewing length 4 mm or greater; body and wings not covered with a whitish powder 2
1′. Forewing length 3 mm or less; body and wings covered with a whitish powder (Fig. 328) . . . . . . Coniopterygidae

2(1). Antennae clubbed or knobbed; abdomen long and slender, somewhat resembling Odonata in appearance (Fig. 1); larvae with robust, curved jaws 3
2′. Antennae filiform, moniliform, or pectinate, not clubbed or knobbed; not resembling Odonata (Fig. 36); larvae with thin, straight or slightly curved jaws 4

3(2). An elongate cell present behind point of fusion of Sc and R_1 in distal part of wing (Figs. 617–622); antennae apically swollen, but not knobbed, and not longer than the head and thorax combined (Fig. 593) . . . . Myrmeleontidae
3′. No elongate cell present behind point of fusion of Sc and R_1 (Figs. 6–11); antennae apically knobbed, usually as long as entire body, but sometimes as short as head and thorax combined (Fig. 1). . . . . Ascalaphidae

4(2′). Prothorax elongate; forelegs greatly enlarged, raptorial (Fig. 537); second and third instar larva sedentary and maggot-like . . . . Mantispidae
4′. Prothorax not elongate; forelegs not greatly enlarged or raptorial (Fig. 36); larvae not maggot-like 5

5(4′). Forewings with two or more branches of Rs arising from the apparently fused stems of R_1 and Rs (Figs. 442–447). . . . . Hemerobiidae
5′. Forewings with all branches of Rs arising from a single sector separate from R_1 (Fig. 36) 6

6(5′). Antennae moniliform in both sexes; ovipositor not projecting 7
6′. Antennae of male pectinate, of female filiform; female with an exserted ovipositor as long as body (Fig. 434) . . . . Dilaridae

7(6). Humeral crossvein recurved, branched; first r-m crossvein in hind wing longitudinal and sigmoid; large species with wing spread of 40–75 mm (Fig. 658) . . . . Polystoechotidae
7′. Humeral crossvein simple, not recurved or branched; first r-m crossvein in hind wing variable in shape; smaller species (most < 40 mm wing span) (Fig. 28) 8

8(7′). Vertex convex; wing venation relatively simple: radial sector of forewings without definitive crossveins (Fig. 660), Sc and R_1 coalesced near wing tip, costal crossveins not forked, r-m crossvein of hind wings in the axis of wing; size small, 6 mm in overall length; paired parapsidial sulci absent on the anterior half of the mesonotum; larvae aquatic, feeding on freshwater sponges . . . . Sisyridae
8′. Vertex flattened; radial sector in forewings with definitive crossveins (Fig. 28); Sc and R_1 coalesced or spearate near wing tip, costal crossveins forked or simple; hind wings with r-m crossvein oblique or transverse; size larger; paired parapsidial sulci present on the anterior half of the mesonotum; larvae terrestrial, sometimes associated with ant or termite nests 9

9(8′). Wing apices rounded, not falcate; costal crossveins simple, not forked; setae on wing veins shorter than cell widths and setae on body shorter than abdominal width; no scales on wings, legs, or body; Rs swinging away from R_1, R_1–Rs area broad and containing many crossveins (Fig. 28) . . . . Chrysopidae

9′. Apical portion of the hind margin of forewings straight or concave (falcate), apex more or less acute (Fig. 27); costal crossveins forked; wings and body very hairy, especially the hind margin of wings (wing vein setae longer than cell width and body setae longer than width of abdomen); wings may bear scales along base of longitudinal veins; R_1–Rs area narrow with few crossveins . . . . Berothidae

FAMILY ASCALAPHIDAE

by
Norman D. Penny

Ascalaphids, or owlflies, are relatively abundant in Costa Rica, and because of their large size and frequent attraction to light are often seen in collections. This family is quite distinctive. Adults superficially resemble dragonflies, except for their long, clubbed antennae (Fig. 1). Larvae are highly predatory, with one subfamily (Ascalaphinae) feeding on soil surface insects and the other (Haplogleniinae) feeding on leaf-dwelling insects. Eggs of Ascalaphinae are often laid at the end of dead twigs with false eggs (repagulae) placed below them (Fig. 4). The repagulae are thought to have a repealant effect on small predators, such as ants. The young larvae spend the first few days of life grouped together at the end of their birth twig before dropping to the ground to begin life at the soil surface as lone predators. Larvae of Haplogleniinae have extremely flattened bodies and blend in very well with the fungus spots often seen on tropical leaves (Fig. 5). They rest quietly on leaves with their long mandibles wide open for days until an unwary insect comes near. Then, with one quick movement the prey is seized. Their metabolic rate must be very low and they can go for long periods without feeding. They are particularly fond of mealy-bugs (Pseudococcidae) and other slow-moving, soft-bodied prey. Adults are most active just at dusk when they dart back and forth after small flying insects. During the day adults rest on vegetation, the Haplogleniinae with wings open and Ascalaphinae with wings closed over the body. Adults of the two subfamilies are easily separated because the Ascalaphinae have a very distinctive partition of the compound eye into upper and lower halves (Fig. 3). This is lacking in Haplogleniinae (Fig. 2) in which the eyes are hemispherical. Accurate species identification in this family is complicated by relatively uniform male genital armature, frequent sexual dimorphism, and considerable intraspecific variation in wing patterning.

KEY TO THE GENERA OF COSTA RICAN ASCALAPHIDAE
(modified from Penny 1981)

1. Eyes entire, hemispherical, not divided by a transverse sulcus (Fig. 2) . . . . Subfamily Haplogleniinae . . . 2

1′. Eyes divided by a transverse sulcus into two equal or unequal parts (Fig. 3) . . . . . . Subfamily Ascalaphinae . . .5

2(1). Forewing axillary angle bearing an acute projection at base (Fig. 11) . . . . *Neohaploglenius*

2′. Forewing axillary angle at base of anal margin right-angled (Fig. 7) 3

3(2′). Antennae longer than distance to second Rs fork of forewing. 4

3′. Antennae shorter than distance to second Rs fork of forewing. . . . . *Ascalobyas*

4(3). Hind wing with 2A present, long; forewing with dark coloration along costal margin (Fig. 7). . . . . . *Haploglenius*

4′. Hind wing with 2A absent or extremely short; forewing with translucent clear coloration along costal margin (Fig. 6) . . . . *Amoea*

5(1′). Hind wing CuP straight (Figs. 12–16); antennae usually as long as forewing (occasionally somewhat shorter) . . . . *Ameropterus*

5′. Hind wing CuP clearly sinuous (Figs. 22–26); antennae much shorter than length of forewing 6

6(5′). Hind wing long and narrow, costal and anal margins approximately parallel (Figs. 22–26) . . . . *Ululodes*
6′. Hind wing subtriangular, much wider at mid-length than near wing base (Figs. 17–21) . . . . *Cordulecerus*

SUBFAMILY HAPLOGLENIINAE

Amoea Lefèbvre, 1842

Amoea is probably the easiest genus of haplogleniine owlflies to recognize because it is the only genus with absolutely no dark pigmentation anywhere on either wing, except at the extreme base. All other genera of haplogleniine owlflies have at least some pigmentation along the costal or subcostal margin of the wings. Although relatively large owlflies, they are the smallest representatives among the Costa Rican Haplogleniinae. This genus also has proportionally broad hind wings, which often protrude dorsally above the forewings when closed. In these respects they closely resemble *Ululodes* and some pale-winged forms of *Cordulecerus* in the Ascalaphinae. However, a look at the undivided eyes will quickly place these insects in the Haplogleniinae.

Described species of *Amoea* display almost no differences from each other except slight differences in size and intensity of a single color pattern. It is likely that many names will be synonymized in the future, and it is possible that only a single species exists.

Only one nominal species of *Amoea* is found in Costa Rica, *Amoea vacuus*.

Amoea vacuus* (Gerstaecker, 1893)
(Fig. 6)

DIAGNOSIS. — As mentioned above, all described species of *Amoea* are very similar, if not identical. Thus, current identification is based solely on geographical distribution.

GEOGRAPHICAL DISTRIBUTION. — Weele (1908) mentioned this species from Honduras. Further specimens have been seen from Mexico (Chiapas State) and Panama. Within Costa Rica, it has been collected most frequently in the drier northeastern part of the country but has been found in the south, on both Caribbean and Pacific coasts.

ALTITUDINAL DISTRIBUTION. — Elevation 30 m at Lomas Barbudal Biological Station (Guanacaste) to 1300 m at Las Mellizas in La Amistad National Park (Puntarenas).

ADULT FLIGHT PERIOD. — The vast majority of specimens have been collected in May, June, and July.

HABITAT PREFERENCE. — Unknown.

Ascalobyas Penny, 1982

This genus of haplogleniine owlflies is characterized by very short antennae, usually reaching only as far as the origin of the radial sector in the forewing. They appear to be large, forest dwelling species, frequently attracted to light. Three species are currently known, distributed from Bolivia and central Brazil north to Mexico, with one record from Texas. Two species are known from Costa Rica.

KEY TO COSTA RICAN *ASCALOBYAS*

1. Apex of forewing pale; pterostigma dark (Fig. 10) . . . . *A. microcerus*
1′. Apex of both wings dark; pterostigmal area pale (Fig. 8) . . . . *A. albistigma*

Ascalobyas albistigma (Walker, 1853)
(Fig. 8)

DIAGNOSIS. — The short antennae, pale stigmal region, and darkly pigmented apical fifth of both wings are distinctive. One other Costa Rican species, *Haploglenius luteus*, also has a pale stigmal area and darkened apex of both pairs of wings, but the antennae are longer, reaching as far as the first radial sector fork. Additionally, *A. albistigma* has a tuft of white setae at the base of each wing and the pleural region of the thorax darkened. *Haploglenius luteus* has dark setae at the wing bases and a diagonal pale stripe on the pleural region. *Ascalobyas albistigma* exhibits sexual dimorphism, with males being smaller and with dark pigmentation fading to transparency at the apex of both wings. Females have darkly marked wings up to the wing apex.

GEOGRAPHICAL DISTRIBUTION. — Weele (1908) mentioned this species from Honduras, Panama, and Colombia; Penny (1981) from the Brazilian Amazon Region and Vogtsberger (1990) reported one specimen from U.S.A. (Texas). Also known from southern Mexico and Belize (unpublished records). Within Costa Rica it has been collected at GUANACASTE: Barra Honda National Park; the west side of Orosi Vulcano at Estacion Maritza; Santa Rosa National Park; LIMÓN: Tortuguero National Park; and PUNTARENAS: Carara Biological Reserve. It appears to be fairly common in Santa Rosa National Park.

ALTITUDINAL DISTRIBUTION. — 300–600 m.

ADULT FLIGHT PERIOD. — May and June, except one collection from Carara Biological Reserve in April.

HABITAT PREFERENCE. — Unknown.

Ascalobyas microcerus Rambur, 1842
(Fig. 10)

DIAGNOSIS. — The short antennae, dark pterostigmal spot, and pale forewing apex separate this from all other species.

GEOGRAPHICAL DISTRIBUTION. — From Mexico (Nayarit, Durango, and San Luis Potosí states) south to central coastal Brazil and Ecuador. In Costa Rica found only at ALAJUELA: San Ramon Forest Reserve.

ALTITUDINAL DISTRIBUTION. — 900 m.

ADULT FLIGHT PERIOD. — April to June.

HABITAT PREFERENCE. — Unknown.

Haploglenius Burmeister, 1839

With seven Neotropical species distributed from Honduras south to Argentina, *Haploglenius* is the most speciose genus of New World haplogleniine owlflies. Species of this genus have relatively long antennae (as long as the forewing to second fork of Rs), forewing with no acute axillary angle at base, and a dark band along the costal margin of both wings (absent in teneral specimens). They are found in forested situations where they rest with wings partially open. Several species are attracted to light. Males have a peculiar flap at the anterior margin of the pronotum which can be flipped back to reveal a bright white patch. Eisner and Adams (1975) thought this to have a startle function towards predators. One additional species was described from Papua New Guinea, but this form almost certainly belongs in another genus. Two species are known from Costa Rica.

KEY TO COSTA RICAN *HAPLOGLENIUS*

1. Apical fifth of hind wings dark (Fig. 7) . . . . *H. luteus*
1′. Hind wings darkened only along apical margin (Fig. 9) . . . . *H. peruvianus*

Haploglenius luteus Walker, 1853
(Fig. 7)

DIAGNOSIS. — Superficially this species appears very similar to *Ascalobyas albistigma*, but the longer antennae extended as far as the forewing second radial sector fork, dark setae at the wing bases and diagonal pale pleural stripe are all characteristic of *Haploglenius*.

GEOGRAPHICAL DISTRIBUTION. — Honduras south to Bolivia and Peru according to Weele (1908). Additional specimens from southern Mexico (unpublished data). In Costa Rica collected at HEREDIA: Braulio-Carrillo National Park, Est. Magsasay; LIMÓN: Cerro Cocori; and Hitoy-Cerere Biological Reserve; PUNTARENAS: Osa Peninsula, Rancho Quemado; Carara Biological Reserve.

ALTITUDINAL DISTRIBUTION. — 50–300 m.

ADULT FLIGHT PERIOD. — March to May, and September (possibly two generations).

HABITAT PREFERENCE. — Unknown.

Haploglenius peruvianus Weele, 1908
(Fig. 9)

DIAGNOSIS: The lack of a prominent axillary angle in the forewing, antennae as long as length of forewing to second radial sector fork, and transparent fore- and hind wings characterize this species. The only other species of this genus in the country is *H. luteus*, which has a prominent dark apex to the hind wing. *Haploglenius peruvianus* closely resembles *H. costatus* from southern South America, which has a uniformly darkened costal area, including pterostigma. The pale stigmal area of *H. peruvianus* is distinctly set off from the darkened costal margin.

GEOGRAPHICAL DISTRIBUTION. — Costa Rica and Panama south to Bolivia, Argentina (Misiones Prov.) and Peru. In Costa Rica collected at HEREDIA: 2 km south of Pueblo Nuevo Sarapiqui; PUNTARENAS: Carara Biological Reserve; and LIMÓN: Hitoy-Cerere Biological Reserve.

ALTITUDINAL DISTRIBUTION. — Up to 100 m elevation.

ADULT FLIGHT PERIOD. — April, July, and September.

HABITAT PREFERENCE. — Unknown.

Neohaploglenius Penny, 1982

This genus was erected for two species from Central America: *Haploglenius angulatus* Gerstaecker and *Haploglenius flavicornis* McLachlan. They appear similar to *Haploglenius* with a dark costal wing margin and long antennae. However, the wings are narrower with associated venational loss, and there is a distinctive axillary angle projection at the base of the forewing, which is absent in *Haploglenius*. The two described species are very similar and are herein considered synonyms. *Neohaploglenius rondonianus* Penny has subsequently been described from the southwestern Brazilian Amazon.

Neohaploglenius flavicornis (McLachlan, 1871)
(Figs. 2, 11)

DIAGNOSIS. — This is the only species of haplogleniine in Costa Rica with the distinctive elongate projection at the base of the forewing (axillary angle) .

GEOGRAPHICAL DISTRIBUTION. — Records indicate a distribution from Mexico (Hidalgo and Sinaloa States) south to Panama. This is probably the most commonly collected haplogleniine ascalaphid in Costa Rica and is in all likelihood found throughout the country at elevations under 1500 m. In Costa Rica collected at the following localities: ALAJUELA: San Ramon Forest Reserve; 2 km southwest of Dos Rios; CARTAGO: Tuisito 1200; GUANACASTE: Guanacaste National Park; Rodriguez National Wildlife Refuge; LIMÓN: Hitoy-Cerere Biological Station PUNTARENAS: Monteverde Biological Reserve; 14.1 mi southeast of Esparta; Osa Peninsula; SAN JOSÉ: Escazú; Finca La Caja; Patarro-Guatuso.

ALTITUDINAL DISTRIBUTION. — 10–1520 m.

ADULT FLIGHT PERIOD. — March to October.

HABITAT PREFERENCE. — Collected in narrow tree line between open pastures near Monteverde Biological Reserve.

REMARKS. — *Haploglenius angulatus* Gerstaecker, 1894 is a **new synonym** of *Neohaploglenius flavicornis*. There can be considerable developmental variation in wing pattern. Approximately one-quarter of specimens of both sexes have smoky dark tints to the wing membrane, perhaps due to killing reagents. Upon emergence, as wings dry and dark patterns develop, the dark subcostal pattern appears before the costal pattern, so that some recently emerged specimens have wings with darkened subcostal area, but translucent costal area. Likewise, the antennae appear yellowish upon emergence, but darken with age.

SUBFAMILY ASCALAPHINAE

Ameropterus Esben-Petersen, 1922

This genus is most easily characterized by the hind wing venation, which includes the MA, MP, and Cu forming a distinctive set of three straight parallel veins angled diagonally across most of the hind wing (Figs. 12–16). The other two genera of Costa Rican Ascalaphinae, *Cordulecerus* and *Ululodes*, both have Cu with an arc at mid-length, thus not parallel to the medial veins (Figs. 17–26). There has been some confusion as to the validity of this genus because one North American species, *Ameropterus excisus* Hagen, has turned out to be the male of *Ululodes quadrimaculata* (Say). The deeply incised, hind wing, anal margin of the male, reduces the wing width at a point where *Ululodes* normally has the arched Cu curvature. The narrowed wing base and parallel MA, MP, and Cu probably is a secondary development for this one species. Most species of *Ameropterus* have antennae as long as the length of the forewing to the pterostigma, and often are longer than the wings. Most species of *Ululodes* have shorter antennae which do not reach to the forewing pterostigma. Male terminalia in the Neotropical members of this subfamily are very similar, if not identical, and thus not useful in identification. *Ameropterus* is an exclusively Neotropical genus, with 21 currently recognized species ranging from southern Mexico (Chiapas state) to northern Argentina. Five of these species are known from Costa Rica.

KEY TO COSTA RICAN *AMEROPTERUS*

1. Small species (forewing length 20 mm or less); hind wing with only six apical forks of CuA; hind wing only about 2/3 length of forewing (Fig. 12) . . . . *A. breviantennis*
1′. Larger species (length 25 mm or more); hind wing with 10 or more apical forks of CuA; hind wing nearly as long as forewing (Figs. 13–16). 2

2(1′). Hind wing much narrower than forewing; anal area of hind wing with distinct axillary angle (Fig. 15) . *A. subripiens*
2′. Hind wing similar in shape to forewing; anal area of hind wing with or without an axillary angle, but never as a distinct lobe (Fig. 13). 3

3(2′). Pterostigmal area of forewing pale, associated veins widely spaced, not swollen (Fig. 14) . . . . *A. mexicanus*
3′. Pterostigmal area of wings darkened, associated veins closely spaced, often swollen (Fig. 16) 4

4(3′). Pterostigmal area large, encompassing three or four cells (Fig. 16); pleural area of thorax pale . . . . *A. trivialis*
4′. Pterostigmal area small, encompassing two cells (Fig. 13); pleural area of thorax dark . . . . *A. consors*

Ameropterus breviantennis Penny, 1982
(Fig. 12)

DIAGNOSIS. — This species is readily recognized by its small size and very short hind wings. It also appears to have a proportionately larger antennal club for the size of its antennae.

GEOGRAPHICAL DISTRIBUTION. — Originally described from the eastern part of the Brazilian Amazon region and has been subsequently collected in Mexico (Chiapas) and Panama. In Costa Rica this species has been collected at ALAJUELA: 2 km southwest of Dos Rios; GUANACASTE: 7 km south of Santa Cecilia; HEREDIA: Magsasay Biological Station, Braulio-Carrillo National Park; Chilamate; La Selva Biological Station; LIMÓN: Cerra Cocori; and PUNTARENAS: Osa Peninsula. This species appears to be most abundant at Pitilla Biological Station in Guanacaste Province.

ALTITUDINAL DISTRIBUTION. — 150–700 m.

ADULT FLIGHT PERIOD. — May to July.

HABITAT PREFERENCE. — Unknown.

Ameropterus consors (Gerstaecker, 1893)
(Fig. 13)

DIAGNOSIS. — This rather large species is characterized by fore- and hind wings of comparable length; no lobe at the base of the anal margin of fore- and hind wings; and small, dark, forewing pterostigmata that encompass only two (occasionally three) cells.

GEOGRAPHICAL DISTRIBUTION. — Originally described from Panama, this species has been collected in Costa Rica seven times at four different sites: ALAJUELA, San Ramon Forest Reserve, Río San Lorencito; Finca San Gabriel, 2 km southeast of Dos Rios; GUANACASTE, Pitilla Biological Station, 9 km south of Santa Cecilia; and PUNTARENAS, La Amistad National Park, Las Mellizas Biological Station, Finca Cafrosa.

ALTITUDINAL DISTRIBUTION. — 600–1300 m.

ADULT FLIGHT PERIOD. — May, with one October record.

HABITAT PREFERENCE. — Unknown.

Ameropterus mexicanus (Weele, 1908)
(Fig. 14)

DIAGNOSIS. — The pale pterostigma, equally-long fore- and hind wings, and lack of a distinctive anal lobe at the base of the forewing serve to characterize this species.

GEOGRAPHICAL DISTRIBUTION. — This species was originally described from Mexico and Honduras. It has been collected in Costa Rica from nine specimens at five different locations: ALAJUELA, San Ramon Forest Reserve, Río San Lorencito, 5 km north of Colonel Palmarena; GUANACASTE, Pitilla Biological Station, 9 km south of Santa Cecilia; PUNTARENAS, La Amistad National Park, Las Alturas Biological Station, Coto Brus; La Amistad National Park, Las Mellizas Biological Station; and SAN JOSÉ, Carara Biological Reserve, Bijagual Biological Station.

ALTITUDINAL DISTRIBUTION. — 500–1500 m.

ADULT FLIGHT PERIOD. — Apparently bimodal: May–June, and September–November.

HABITAT PREFERENCE. — Unknown.

NOTE. — The similarity in appearance and collecting sites and dates between *A. consors* and *A. mexicanus* leads one to question the separation of these two species. Because the pterostigma is so strikingly contrasted in the two forms, they are maintained as separate species for the present, although this is normally a very weak character to use for species separation and these forms may later be synonymized.

Ameropterus subripiens (Walker, 1853)
(Fig. 15)

DIAGNOSIS. — The distinctively narrowed hind wings of this species immediately separate it from all other *Ameropterus* known from Costa Rica. In the forewings, the base of the anal margin has a small lobe. In the hind wings, the base is very constricted with a very pronounced basal lobe.

GEOGRAPHICAL DISTRIBUTION. — This species was described from Venezuela. There is a specimen in the Natural History Museum (London) from Panama. In Costa Rica, this species has been collected only three times, at two localites: HEREDIA, Braulio-Carrillo National Park, Magasay Biological Station; and PUNTARENAS, Manuel Antonio National Park, Quepos.

ALTITUDINAL DISTRIBUTION. — 80–200 m.

ADULT FLIGHT PERIOD. — February to May.

HABITAT PREFERENCE. — Unknown.

Ameropterus trivialis (Gerstaecker, 1888)
(Fig. 16)

DIAGNOSIS: The combination of uniformly long fore- and hind wings, which lack an anal lobe and dark pterostigmata that encompass four or five costal cells are diagnostic.

GEOGRAPHICAL DISTRIBUTION. — This species was originally described from Panama. There are specimens from Mexico (Chiapas) in the collections of the Canadian National Collection and the University of Nebraska and a specimen from Guatemala in the collection of California Academy of Sciences. Banks mentioned this species from Costa Rica as early as 1914. This is the most common species of *Ameropterus* in the country and has been collected numerous times at the following localities: ALAJUELA, 20 km south of Upala; Finca San Gabriel, 2 km southwest of Dos Rios; San Ramon Forest Reserve, Río San Lorencito; CARTAGO, Juan Viñas; Turrialba; GUANACASTE, Maritza Biological Station, west side of Orosí Volcano; HEREDIA, Braulio-Carrillo National Park, Magasay Biological Station; LIMÓN, Cerro Cocori Sector, Finca de E. Rojas; Braulio-Carrillo National Park, Quebrada Gonzalez; and PUNTARENAS, Carara Biological Reserve, Quebrada Bonita Biological

Station; Manuel Antonio National Park, Quepos; Osa Peninsula, Rancho Quemado; Osa Peninsula, 2.9 km (1.8 mi) west of Rincon; Golfito; Las Cruces, near San Vito.

ALTITUDINAL DISTRIBUTION. — Sea level to 600 m.

ADULT FLIGHT PERIOD. — February to July, with a peak in May.

HABITAT PREFERENCE. — Unknown.

Cordulecerus Rambur, 1842

Most species of this genus have distinctive pigmentation patterns on the wings. However, unlike the brightly colored diurnal European *Libelloides* Schäffer, species of *Cordulecerus* are crepuscular and nocturnal. In their most developed form, the wings (particularly the hind wings) are also very distinctively broadened at mid-length. Identification has at times been confused by the highly dimorphic wing color patterns of some species. Species of this genus also form mixed-sex aggregations of up to 50 individuals clustered at the tips of tree branches and vines, often overhanging water (Covell 1989; Hogue and Penny 1989; Gomes-Filho 2000). This behavioral trait is unknown in other ascalaphids. *Cordulecerus* can be characterized by the mid-length arch in hind wing vein Cu, and the hind wings broader than the forewings. This genus is exclusively Neotropical, with 10 species and one subspecies known from southern Mexico south to central Brazil. Three species are known from Costa Rica.

KEY TO COSTA RICAN *CORDULECERUS*

1. Smaller species (forewing length 20–28 mm) with series of four or more broken or interconnected dark markings on posterior hind wing margin (Fig. 21) . . . . *C. subiratus*
1′. Larger species (forewing length 25–30 mm) with clouded regions or three spots on posterior hind wing margin (Fig. 20) 2

2(1′). No dark spots on hind wing basal half (Figs. 17, 19) 3
2′. Dark areas on hind wing basal half (Figs. 18, 20) 4

3(2). Apex of fore and hind wings clear and transparent or somewhat evenly enbrowned (Fig. 17). . . . male *C. inquinatus*
3′. Apex of fore and hind wings contrastingly darker tinted than base (Fig. 19) . . . . male *C. praecellens*

4(2′). Base of hind wing more or less evenly translucent, with three dark spots along hind margin (Fig. 20) . . . . female *C. praecellens*
4′. Base of hind wing dark, with dark area along most of hind margin (Fig. 18) . . . . female *C. inquinatus*

Cordulecerus inquinatus Gerstaecker, 1888
(Figs. 17, 18)

DIAGNOSIS. — This species is highly dimorphic, with wings uniformly clouded with pale brown (males), or dark areas along the costal margin of the forewing and over much of the hind wing (females). Hind wings have a broad basal expansion along the posterior margin. The location of pigmentation on the female wings is similar to that of *C. subiratus* although more diffuse and less fragmented, but the pattern of males is very different (no discrete markings), and *C. subiratus* is a much smaller species.

GEOGRAPHICAL DISTRIBUTION. — This species has been reported from Costa Rica, Panama, Ecuador and Peru. Within Costa Rica it has been collected repeatedly from: ALAJUELA: San Ramon Forest Reserve, Río San Lorencito. It is also known from SAN JOSÉ: Braulio-Carillo National Park, Quebrada Gonzalez.

ALTITUDINAL DISTRIBUTION. — 480–980 m.

ADULT FLIGHT PERIOD. — May to July, with most records from May.

HABITAT PREFERENCE. — Unknown.

Cordulecerus praecellens (Gerstaecker, 1884)
(Figs. 19, 20)

DIAGNOSIS. — Medium-sized species (forewing length 29 to 30 mm). Males have somber wings created by dark margining of all veins, with more intense darkening near tip of wings. Forewings of females are translucent, except for diffuse darkening at wing tips, and hind wings have a series of three dark spots along the posterior margin (including the apical spot).

GEOGRAPHICAL DISTRIBUTION. — This species is known from Costa Rica, Panama, Venezuela and Ecuador. Within Costa Rica records are from: ALAJUELA, two km southwest of Dos Rios, Finca San Gabriel; HEREDIA, Braulio-Carrillo National Park, Magasay Biological Station; LIMÓN, Hitoy-Cerere Biological Reserve, Hitoy-Cerere Biological Station; and PUNTARENAS, La Amistad National Park, Las Mellizas Biological.

ALTITUDINAL DISTRIBUTION. — 100–1300 m.

ADULT FLIGHT PERIOD. — Costa Rican records suggest a rather narrow adult activity period from May to June, at the height of the late spring/early summer rains.

HABITAT PREFERENCE. — Records suggest a preference for forested habitats.

Cordulecerus subiratus (Walker, 1853)
(Fig. 21)

DIAGNOSIS. — This is the smallest of the three Costa Rican species of *Cordulecerus* (forewing length 23 to 27 mm), and the only one with little or no wing pattern sexual dimorphism. Forewings are basally diffusely darkened and apically translucent, except for a thin, broken line from pterostigma to wing apex. Hind wings have a unique color pattern which is completely dark in the basal third and translucent in the apical 2/3, with a series of elongate dark markings inward from the posterior margin, some of which are connected.

GEOGRAPHICAL DISTRIBUTION. — This species is known from southern Mexico, Guatemala, Honduras, Costa Rica, and Brazil. The Brazilian population is so isolated that it may represent a separate, cryptic species. Within Costa Rica it has only been collected at: GUANACASTE, Santa Rosa National Park, Santa Rosa Biological Station.

ALTITUDINAL DISTRIBUTION. — 300 m.

ADULT FLIGHT PERIOD. — There appears to be a short adult activity period. All 16 known specimens were taken in May and June.

HABITAT PREFERENCE. — Unknown.

Ululodes Currie *in* Smith, 1900

Species can be characterized as having divided compound eyes, no anal lobe at the base of the hind wing, a hind wing CuP vein which is strongly arched at mid-length, and hind wings of similar width as the forewings. This is the largest and most frequently encountered genus of New World ascalaphids, with 22 recognized species ranging from southern Canada south to northern Argentina. Within Costa Rica three species are known.

KEY TO COSTA RICAN *ULULODES*

1. Pterostigmata of fore and hind wings similar in coloration, either all dark or all pale (Fig. 25) 2
1′. Pterostigma of forewing pale, that of hind wing dark (Figs. 22, 23) . . . . *U. bicolor*

2(1). Pterostigmata of fore- and hind wings dark (Fig. 25, 26) . . . . *U. macleayanus*
2′. Pterostigmata of fore- and hind wings pale (Fig. 24) . . . . *U. cajennensis*

Ululodes bicolor (Banks, 1895)
(Figs. 22, 23)

DIAGNOSIS. — Among the three closely-related, Costa Rican species this one is distinguished by having pale forewing pterostigmata and dark hind wing pterostigmata. Males generally have completely translucent wings but sometimes have a small substigmal mark on the hind wings, while females have the apical fifth of the hind wings darkened.

GEOGRAPHICAL DISTRIBUTION. — This species is currently known from the southwestern United States, Mexico, Honduras, Costa Rica, and Panama. Within Costa Rica it has been collected at: GUANACASTE, 14 km south of Cañas; Pitilla Biological Station, 7 km south of Santa Cecilia; HEREDIA, La Selva Biological Station; 2 km south of Pueblo Nuevo, Finca Naranjo; Braulio-Carrillo National Park, Magsasay Biological Station; LIMÓN, Tortuguero National Park, Cerro Tortuguero; Hitoy-Cerere Biological Reserve, Hitoy-Cerere Biological Station; PUNTARENAS, Osa Peninsula, Rancho Quemado; Corcovado National Park, Sirena Biological Station; and SAN JOSÉ, Escazú.

ALTITUDINAL DISTRIBUTION. — Sea level to 500 m.

ADULT FLIGHT PERIOD. — Encountered throughout the year.

HABITAT PREFERENCE. — Records suggest that this species frequents open areas at forest margins.

Ululodes cajennensis (Fabricius, 1787)
(Fig. 24)

DIAGNOSIS. — This species has pale pterostigmal spots, and no dark pigmentation on the wings of either sex.

GEOGRAPHICAL DISTRIBUTION. — Very widely distributed throughout Mexico, Guatemala, Costa Rica, St. Lucia Island, Venezuela, Guyana, Surinam, French Guiana, Ecuador, Peru, Brazil, Paraguay, and Argentina. In Costa Rica this species is known from: ALAJUELA, Gonzita; Guatuso, La Garroba; Dos Rios-Upala, Finca La Selva; GUANACASTE, Finca Jenny, 31 km north of Liberia; 14 km south of Cañas; Palo Verde National Park, Palo Verde Biological Station; Finca La Flor; HEREDIA, 2 km south of Pueblo Nuevo, Finca Naranjo; Braulio-Carrillo National Park, Magsasay Biological Station; LIMÓN, Hitoy-Cerere Biological Reserve, Hitoy-Cerere Biological Station; Gandoza and Manzanillo Forest Reserve, Manzanillo; Cerro Cocori Sector, E. Rojas Finca, Finca La Lola, near Siquirres; PUNTARENAS, Osa Peninsula, Rancho Quemado; SAN JOSÉ, Escazú; Carara Biological Reserve, Bijagual Biological Station.

ALTITUDINAL DISTRIBUTION. — Sea level to 500 m.

ADULT FLIGHT PERIOD. — Adult activity appears to be bimodal: March to June, and September to January. Peak activity is in March and April in the San José area.

HABITAT PREFERENCE. — This species prefers open fields near forest edges.

Ululodes macleayanus (Guilding, 1825)
(Figs. 1, 3, 25, 26)

DIAGNOSIS. — Characterized by having dark pterostigmata on both pairs of wings. Males have entirely translucent wings, while females often have a large subapical dark spot on the hind wing along the costal margin near the pterostigma, sometimes extending to the posterior margin as well.

GEOGRAPHICAL DISTRIBUTION. — This is the most common and widely distributed ascalaphid in the New World, and is the most commonly encountered species in Costa Rica, especially in the northern part of the country. It is known from the southeastern United States, Cuba, Haiti, St. Lucia Island, St. Vincent Island, Costa Rica, Colombia, Venezuela, Brazil, and Argentina. In Costa Rica it has been collected at: CARTAGO, Turrialba; GUANACASTE, 14 km south of Cañas; Guanacaste National Park, Santa Rosa Biological Station; 30 km north of Liberia, Finca Jenny; 8 km southwest of Cuajiniquil, Murcielago Biological Station; Los Almendros; Palo Verde National Park, Palo Verde Biological Station; Rafael Lucas Rodriguez National Wildlife Refuge, Palo Verde; 12 km southeast of La Cruz, Cerro El Hacha; Barra Honda National Park, 3 km northwest of Nacaume; HEREDIA, Braulio-Carrillo National Park, Magsasay Biological Station; 2 km south of Pueblo Nuevo, Finca Naranjo; and LIMÓN, Cerro Cocori Sector, E. Rojas Finca.

ALTITUDINAL DISTRIBUTION. — Sea level to 300 m.

ADULT FLIGHT PERIOD. — Encountered year round.

HABITAT PREFERENCES. — This species, like others in this genus, appears to prefer dry, open or scrub areas near forest edges. Often these areas include cultivated fields.

FAMILY BEROTHIDAE

by
Norman D. Penny

Berothids, beaded lacewings, are fairly common in the warmer parts of North America where termites are abundant. Some species of *Lomamyia* are known to live in termite nests as larvae, feeding on the termites by injecting a paralyzing toxin into the termite, then sucking out body fluids. Termites apparently never recognize these larval berothids as nest intruders. In South America, berothids are much rarer, and most austral species belong to a separate, primitive subfamily. Central American berothids were first described by Adams (1990). Only one species occurs in Costa Rica, *Spiroberotha sanctarosae*.

Spiroberotha sanctarosae Adams, 1990
(Fig. 27)

DIAGNOSIS. — Like most berothids, this species superficially resembles a brown lacewing in size and coloration, but is more delicate in appearance, with narrower falcate wings and long, abundant pilosity.

GEOGRAPHICAL DISTRIBUTION. — This species is only known from Costa Rica and appears to be confined to GUANACASTE, in Santa Rosa National Park; south of Cañas; and at La Pacifica, just north of Cañas.

ALTITUDINAL DISTRIBUTION. — Near sea level.

ADULT FLIGHT PERIOD. — December to May, indicating adult activity during the driest time of the year in Guanacaste Province.

HABITAT PREFERENCE. — Known hosts for New World berothids include only dry-wood termites, primarily *Reticulotermes* spp. Thus, the open, semiarid, deciduous woodlands of Guanacaste Province seem ideally suited for both termites and berothids.

FAMILY CHRYSOPIDAE

by
Norman D. Penny

The green lacewings constitute the second largest family of the order Neuroptera. However, in humid tropical forest regions chrysopids far surpass the myrmeleontids in species richness, while myrmeleontids are more speciose in more arid areas. This general observation holds true for the Costa Rican fauna, with the Chrysopidae being overall the most abundant and specious family, and with the Myrmeleontidae reaching their greatest abundance and diversity in the relatively dry Guanacaste Province.

A normal chrysopid egg is oval and placed at the end of a long filamentous stalk which raises the egg above the substrate. Some species place their eggs singly, others in large groups, and some even intertwine the stalks to form a mass of eggs. Female green lacewings are able to sense chemicals in the air emitted from honeydew and other concentrated secretions of phytophagous insects. Eggs are then laid close to these initial food sources. Attempts have been made to enhance the number of eggs laid in agricultural areas by spraying artificical "honeydew" onto crops to attract female chrysopids for oviposition. These insects are among our most beneficial insects, because larvae feed on eggs, larvae and adults of a wide variety of phytophagous homopterans and other relatively sedentary insects. Over the approximately two to three week period it takes for the larva to develop and pupate, hundreds of small insects or thousands of insect eggs can be consumed. Some green lacewing larvae have thoracic projections and long setae to hold the dried skeletons of prey and other bits of debris over their bodies so that the larva is well protected from visual predators, as well as from other predators and parasites. This type of larva is called a "trash-carrier," and in the forest they appear as small pieces of debris slowly moving along a leaf, twig or tree trunk. Adults feed on pest insects, honeydew, and pollen. Adults of the genus *Chrysoperla*, which are ubiquitous in agricultural areas, are known to feed on grass pollen (Ken Hagen, personal communication).

The most recent generic revision of the Chrysopidae (Brooks and Barnard 1991) lists three subfamilies, two of which are found in Costa Rica. Only two species of the Apochrysinae are currently known from the country, while three tribes and 72 species of Chrysopinae are found here. The chrysopid fauna of Costa Rica is very rich, especially for such a small country, and more species can be expected to be encountered in the future.

The genera of Chrysopini are very difficult to identify to genus based solely on females. The genera of this tribe are recognized mostly by elements of the male genitalia. Thus, the generic key uses non-genitalic characters for other tribes, but relies on male genitalic structures within the Chrysopini.

KEY TO THE GENERA OF COSTA RICAN CHRYSOPIDAE
(modified from Henry et al. 1992)

1. Basal antennal segments wider than long; rather stout, wide-bodied species (Fig. 133); male with tignum absent, gonapsis may be present as two separate projections or a two-horned plate; female with or without praegenitale . . . . Tribe Belonopterygini . . . . *Nacarina*

1′. Basal antennal segments longer than wide; rather thin, slender-bodied species (Fig. 35); male with tignum present or absent (Fig. 29); gonapsis, if present, not a two-horned plate; female without praegenitale 2

2(1′) No dark spot at base of pterostigma (Fig. 141); antennae shorter than 1.3 times forewing length; male with tignum present or absent, gonapsis present or absent (males required for further identification in this key) . . . . Tribe Chrysopini 4

2′. A dark spot at base of stigma (Fig. 48); antennae distinctly longer than 1.3 times forewing length; male without tignum or gonapsis 3

3(2′). In forewing, basal subcostal crossvein and intramedian cell absent; distinct blister-like bullar spots present (Fig. 33). . . . . Subfamily Apochrysinae 15
3′. In forewing, basal subcostal crossvein and intramedian cell present; bullar spots absent (Fig. 45) . . . . Tribe Leucochrysini 11

4(2). Male without tignum 7
4′. Male with tignum (Fig. 29) 5

5(4′). Male with pseudopenis (Fig. 29). 6
5′. Male without pseudopenis . . . . *Chrysoperla*

6(5). Male with enlarged or modified antennal bases and/or with facial horns (Figs. 314, 315); gonapsis (Fig. 29) usually present . . . . *Meleoma*
6′. Male without modified antennal bases or facial horns (Fig. 317, 320); gonapsis absent . . . . *Plesiochrysa*

7(4). Male with base of ectoproct not extended basally to articulate with base of sternite 8 + 9; ectoprocts fused dorso-medially at base; dorsal apodeme oriented vertically through callus cerci (Fig. 325) . . . . *Ungla*
7′. Male with base of ectoproct extended basally to articulate with base of sternite 8 + 9; ectoprocts not fused dorso-medially; dorsal apodeme oriented horizontally, often branched around callus cerci and ventral branch extended beneath ectoproct as apical point (Fig. 162) 8

8(7′). Male with two horn-like structures on gonarcus or arcessus (Fig. 169); gonapsis elongate (Fig. 170) *Ceraeochrysa*
8′. Male without horn-like structures on gonarcus-arcessus; gonapsis absent or present, but not elongate (Fig. 281) 9

9(8′). Male with pseudopenis (Fig. 29) . . . . *Meleoma*
9′. Male without pseudopenis 10

10(9′). Mandibles blunt-tipped; wings usually with narrow costal area; male without gonapsis *Chrysopodes* (*Neosuarius*)
10′. Mandibles with slender fang-like tips; wings usually with wide costal area; gonapsis present in males of a few species . . . . *Chrysopodes* (*Chrysopodes*)

11(3′). In forewing one crossvein from MP to R + MA present before origin of PsM (Fig. 36) . . . . *Berchmansus*
11′. In forewing crossveins from MP to R + Ma absent before origin of Psm (Fig. 42) 12

12(11′). Forewing with costal area very broad with sigmoidally undulating crossveins (Fig. 129 . . . . *Vieira*
12′. Forewing with costal area bearing straight crossveins (Fig. 42) 13

13(12′). Forewing with intramedian cell triangular, MP_2 joining MP_1 before end of cell (Fig. 63) . . *Leucochrysa* (*Nodita*)
13′. Forewing with intramedian cell quadrangular, MP_2 not joining MP_1 (Fig. 60) 14

14(13). Forewing pterostigma with a large black spot extending back to radial sector (Fig. 42); costal stigmal area usually twice as broad as subcostal stigmal area . . . . *Gonzaga*
14′. Forewing pterostigmal mark much smaller (Fig. 60); costal stigmal area rarely twice as broad as subcostal stigmal area . . . . *Leucochrysa* (*Leucochrysa*)

15(3). Forewing with an arc of seven or more blister-like bullae (Fig. 33) . . . . *Loyola*
15′. Forewing with only two blister-like bullae (Fig. 30) . . . . *Domenechus*

SUBFAMILY APOCHRYSINAE

These are the largest and broadest winged of green lacewings. Their flight through the forest is slow and graceful, much like that of a translucent-winged butterfly. Little is known of their biology. They are usually found resting under leaves well within the forest. Their broad wings do not allow them to fold the wings roof-like over the abdomen, as in other chrysopids, but rather they are held horizontally when at rest. There are only 26 species and subspecies in 12 genera worldwide (Brooks and Barnard 1990), and they are seldom collected. In the New World there are four genera and seven species, distributed from Mexico and the Dominican Republic south to southern Brazil. All New World species have raised, shiny, dark spots called bullae on the forewings. Two genera and species have been collected in Costa Rica.

Domenechus Navás, 1913

This genus is easily recognized by the two dark bullae on the forewing and the lack of bullae on the hind wing. There are two described species in this genus: *Domenechus marionella* (Guérin-Ménéville) from the Amazon Basin of Brazil and *Domenechus mirifica* (Gerstaecker) from Central America.

Domenechus mirifica (Gerstaecker, 1888)
(Figs. 20–32)

DIAGNOSIS. — As for the genus, see above.

GEOGRAPHICAL DISTRIBUTION. — Gerstaecker (1888) originally described this species under the name *Apochrysa mirifica* from Panama. In 1913 Navás described this same species under another name, *Domenechus sigillatus* from Guatemala. Within Costa Rica, this species is known only from: PUNTARENAS: Golfito, and La Suerte.

ALTITUDINAL DISTRIBUTION. — The Golfito records are from the lowlands near sea level.

ADULT FLIGHT PERIOD. — The specimen from La Suerte was captured in August whereas the Golfito specimens were collected in July.

HABITAT PREFERENCE. — Other apochrysines have been collected in primary forest and the Golfito records on the Osa Peninsula also suggest a lowland primary forest habitat.

Loyola Navás, 1913

This genus is immediately recognizable by the numerous (>3) blistered spots (bullae) on the forewing, presence of pigmented blistered spots on the hind wing, and the multiple rows of forewing gradate veins forming a reticulate web of crossveins in the distal half of both wings. There are two recognized species in this genus, ranging from Mexico to Brazil. Only one, *Loyola croesus*, has been collected in Costa Rica.

Loyola croesus (Gerstaecker, 1893)
(Figs. 33–35)

DIAGNOSIS. — This species is unmistakable. It is not only the largest green lacewing found in the New World, but has broader wings than others, and a characteristic arc of seven dark bullae across each forewing.

GEOGRAPHICAL DISTRIBUTION. — This species is known from Costa Rica, Panama, Venezuela, and eastern Peru. Within Costa Rica it has been collected only twice: CARTAGO, Santa Teresita de Lajas, near Turrialba; and Tuís.

ALTITUDINAL DISTRIBUTION. — So far, in Costa Rica this species is only known from mid-elevation levels on the Caribbean side of mountain slopes near Turrialba and Tuís.

ADULT FLIGHT PERIOD. — The only recorded date for Costa Rica is in June.

HABITAT PREFERENCE. — Although there is no information on habitat preferences for this species, apochrysines collected in Africa, Australia, Papua New Guinea and the Brazilian Amazon have all been associated with understory vegetation in primary forests.

SUBFAMILY CHRYSOPINAE
TRIBE LEUCOCHRYSINI

The leucochrysines are the dominant group of green lacewings in Neotropical forests. They are characterized by having very long antennae that extend beyond the wing apices, and a pseudomedial vein in the forewing that curves directly into the outer gradate series of crossveins. The pterostigma is darkly pigmented, although occasionally, particularly in teneral specimens, this pigmentation is not developed. The Chrysopini genus *Chrysopodes* occasionally has a species with some darkening of the pterostigma. However, in general this characteristic is useful for quick recognition. Larvae are trash-carriers. Although dominant in forest habitats, they are only infrequently seen in more open habitats, such as cultivated lands.

This is a very large tribe with many undescribed species. One estimate (Adams 1978) puts the total number of valid species in the subgenus *Leucochrysa* (*Nodita*) at 200 or more. There are four genera found in Costa Rica, with *Leucochrysa* (*Nodita*) being by far the most speciose and abundant.

***Berchmansus* Navás, 1913**

This is the only leucochrysine genus with a presectoral crossvein. Three species have been described, distributed from Costa Rica to central Brazil. Only one, *Berchmansus elegans* has been collected in Costa Rica.

***Berchmansus elegans* (Guérin-Ménéville, 1838)**
(Figs. 36–38)

DIAGNOSIS. — This is the only species of *Berchmansus* known from Costa Rica, so characters that define the genus will also serve to distinguish this species. Additionally, the heavily pigmented forewing (Fig. 36) is found in no other species of green lacewing from this region, except perhaps *Vieira leschnaulti*, which is much larger and has a quite different pigment pattern.

GEOGRAPHICAL DISTRIBUTION. — This species has previously been collected in Surinam and Brazil. This is the first record for this species from Central America and Costa Rica. It was found at: PUNTARENAS: Las Alturas, near San Vito in La Amistad National Park.

ALTITUDINAL DISTRIBUTION. — 1500 m.

ADULT FLIGHT PERIOD. — The only record available is in May.

HABITAT PREFERENCE. — Unknown.

***Gonzaga* Navás, 1913**

Gonzaga is closely related to *Leucochrysa* (*Leucochrysa*) having in common with this subgenus the quadrate intramedian cell. Species of *Gonzaga* usually have a darkly pigmented frons and vertex of the head and mesonotum of the thorax, while the pronotum is pale green. The wings are usually more heavily pigmented than in *Leucochrysa*, especially in the area of the pterostigma, where the dark pigment will extend from the pterostigma into the radial area. There are seven currently recognized species in this genus, distributed from Guatemala south to Brazil and Peru. Two species have been collected in Costa Rica.

KEY TO COSTA RICAN *GONZAGA*

1. Dark spot at intersection of Psm and outer gradate veins (Fig. 42) . . . . *G. torquatus*
1′. No dark pigmentation on forewing apical area, except around pterostigma (Fig. 39) . . . . *G. palliceps*

***Gonzaga palliceps* (McLachlan, 1867) [new combination from *Leucochrysa*]**
(Figs. 39–41)

DIAGNOSIS. — This species has the least wing pigmentation of any of the *Gonzaga* species, with dark markings confined to the pterostigmal area. The vertex of the head is also mostly pale, with dark markings confined to the area just behind the antennae. However, the quadrate intramedian cell, pale pronotum and dark mesonotum along with dark wing markings in the pterostigmal area, which extend into the radial area, will distinguish this species as a *Gonzaga*.

GEOGRAPHICAL DISTRIBUTION. — This species is known from Costa Rica, Guyana, and Brazil. Within Costa Rica it has been collected at: LIMÓN, in the Cerere River Valley, both at Pandora and Hitoy-Cerere Biological Station; and PUNTARENAS, Golfito.

ALTITUDINAL DISTRIBUTION. — Lowlands below 200 m on both coasts.

ADULT FLIGHT PERIOD. — March, July, and September.

HABITAT PREFERENCE. — This species was collected on understory saplings in mature forest near small streams. They were particularly abundant along a small stream on an isolated wooded hillside near the headquarters of the Del Monte Banana Plantation in the Valle de Estrella.

***Gonzaga torquatus* Navás, 1913**
(Figs. 42–44)

DIAGNOSIS. — This species can be characterized as having a very large dark mark over the pterostigmal area, which extends posteriorly beyond R_1. There is a second rhegmal spot where the outer gradates merge with the pseudomedial vein

GEOGRAPHICAL DISTRIBUTION. — This species is known from Guatemala, Costa Rica, Panama, Venezuela and Brazil. Within Costa Rica this species has been collected at: ALAJUELA, Finca La Selva, Dos Rios; LIMÓN, Pandora; PUNTARENAS, Osa Peninsula, 2.9 km (1.8 mi) west of Rincon; and SAN JOSÉ, San José.

ALTITUDINAL DISTRIBUTION. — The Pandora and Rincon specimens are from less than 100 m elevation.

ADULT FLIGHT PERIOD. — Costa Rican records are from March, June, and September.

HABITAT PREFERENCE. — The Pandora specimen was collected together with *Gonzaga palliceps* on understory saplings on a forested hillside along a small stream.

Leucochrysa McLachlan, 1868

Leucochrysa is a very large genus with 161 currently recognized species. The genus is found only in the New World, primarily in the tropics, where it has become the most diverse genus of chrysopids in the Neotropical Region. Most species are closely associated with forested areas, although they can sometimes be found in orchards. The genus is usually divided into two subgenera—*Leucochrysa* (*Leucochrysa*) and *Leucochrysa* (*Nodita*).

Leucochrysa (*Leucochrysa*) McLachlan, 1868

This subgenus is characterized by having a more or less quadrate intramedian cell in the forewing (Fig. 45). These species are generally larger than *Leucochrysa* (*Nodita*), with longer series of gradate veins. There are 41 known species ranging from the northeastern United States south to Argentina. Several unpublished synonyms exist in this subgenus. Six species have been collected in Costa Rica.

KEY TO COSTA RICAN *LEUCOCHRYSA* (*LEUCOCHRYSA*)

1. Vertex and mesoscutellum with bright white spots when alive, creamy yellow spots when dead (Fig. 59) . . . . *L.* (*L.*) *magnifica*
1′. Vertex and mesoscutellum green, pale yellow or brown with various markings, but never with white or creamy yellow spots (Fig. 50) 2

2(1′). Forewing with a dark transverse stripe from base of Rs to anal margin (Fig. 48) . . . . *L.* (*L.*) *clara*
2′. Forewing in some individuals with dark markings but never with a transverse stripe from base of Rs to anal margin (Fig. 45) 3

3(2′). Pronotum with a dark longitudinal stripe on each side (Fig. 47) 4
3′. Pronotum with only slight dark mottling laterally (Fig. 62) 5

4(3). Frons pale yellow; two dark spots on mesonotum (Fig. 47) . . . . *L.* (*L.*) *adamsi*
4′. Frons green; dark arc across anterior margin of mesonotum (Fig. 56) . . . . *L.* (*L.*) *lestagei*

5(3′). Metascutum dark; metascutellum pale (Fig. 62) . . . . *L.* (*L.*) *pretiosa*
5′. Metascutum pale; metascutellum dark (Fig. 53) . . . . *L.* (*L.*) *colombia*

Leucochrysa (*Leucochrysa*) *adamsi* Penny, 2001
(Figs. 45–47)

DIAGNOSIS. — The narrow dark lateral line of the pronotum and two dark spots on the mesoscutum are unique among Costa Rican *Leucochrysa* (*Leucochrysa*) and the dark region in the radial area of the forewing is found in some *Leucochrysa* (*Nodita*), but not in other *Leucochrysa* (*Leucochrysa*).

GEOGRAPHICAL DISTRIBUTION. — Originally described from Cuba, and subsequently cited from Honduras (under the name *L. navasi*). This species has been collected only once in Costa Rica: LIMÓN, Pandora.

ALTITUDINAL DISTRIBUTION. — 40 m.

ADULT FLIGHT PERIOD. — September.

HABITAT PREFERENCE. — The Pandora specimen was collected together with *Gonzaga palliceps* on a forested hillside along a small stream bordered by understory saplings.

Leucochrysa (*Leucochrysa*) *clara* (McLachlan, 1867)
(Figs. 48–50)

DIAGNOSIS. — This is one of the larger species of *Leucochrysa*. It has a distinctive dark marking on the forewing running transversely from the origin of the radial sector to the base of the posterior wing margin. No other species of *Leucochrysa* has such a mark.

GEOGRAPHICAL DISTRIBUTION. — This species has been recorded from Costa Rica, Panama, Colombia, Ecuador and Brazil. Within Costa Rica, records are from: ALAJUELA, 20 km south of Upala; San Ramon Forest Reserve, Río San Lorencito; GUANACASTE, 14 km south of Cañas; and PUNTARENAS, San Vito.

ALTITUDINAL DISTRIBUTION. — Pacific Coast lowlands.

ADULT FLIGHT PERIOD. — Numerous records from near Upala indicate the presence of adults throughout the year.

HABITAT PREFERENCE. — Unknown.

Leucochrysa (Leucochrysa) colombia (Banks, 1910)
(Figs. 51–53)

DIAGNOSIS. — This species is very similar to *Leucochrysa pretiosa*, except that *Leucochrysa colombia* has lateral reddish brown markings on the pronotum, with variable amounts of dark pigmentation on the mesonotum, from an anterior arc to the whole notal area, metascutum pale at least laterally, and metascutellum dark. The outer gradate crossveins of the forewing are dark, but not margined, and apical forks at the wing apex are pale.

GEOGRAPHICAL DISTRIBUTION. — This species is only known from Costa Rica, Colombia, and Ecuador. The only locality within Costa Rica where it has been collected is: PUNTARENAS, La Amistad National Park, Las Alturas.

ALTITUDINAL DISTRIBUTION. — 1500 m. This may be a mid-elevational species.

ADULT FLIGHT PERIOD. — Mid-February to early March. This is the driest time of the year in the Talmanca Mountains rain shadow area of La Amistad National Park.

HABITAT PREFERENCE. — Collected on understory saplings, including many *Peperonia* plants, in mixed montane primary forest with many large *Ficus* trees.

Leucochrysa (Leucochrysa) lestagei Navás, 1922
(Figs. 54–56)

DIAGNOSIS: Characteristics include a broad, brown, lateral stripe on the anterior 2/3 of pronotum and all of the mesonotum; remainder of the thorax is pale green. The frons has a broad transverse red band.

GEOGRAPHICAL DISTRIBUTION. — This species has been reported from Costa Rica, Ecuador, and Brazil. Within Costa Rica, records are from: PUNTARENAS, La Amistad National Park, Las Alturas; Las Cruces (San Vito). Navás (1922) also published two records from the Caribbean lowlands based on material subsequently destroyed in the Hamburg Museum: LIMÓN, Río Reventazón, Finca Hamburgo; and Las Mercedes, Santa Clara

ALTITUDINAL DISTRIBUTION. — Existing specimens indicate the presence of this species only at mid-elevations on the Pacific side, or, if Navás' records are included, also in the Caribbean lowlands.

ADULT FLIGHT PERIOD. — Pacific mid-elevational records are from late February to April, the driest time of year in this region. One Caribbean lowland record is for August.

HABITAT PREFERENCE. — Collected on understory saplings, including many *Peperonia* plants, in mixed montane primary forest with many large *Ficus* trees.

Leucochrysa (Leucochrysa) magnifica (Banks, 1920)
(Figs. 57–59)

DIAGNOSIS. — This species is recognizable by two, very distinctive spots of bright white, one on the vertex and the other on the mesoscutellum. These spots in a live individual are easily visible to the unaided eye. However, they fade to a creamy yellow after death. There is also a diagonal dark band along the apical forkings of the forewing longitudinal veins.

GEOGRAPHICAL DISTRIBUTION. — Originally described from the southwestern part of the Brazilian Amazon Basin, *L. magnifica* has also been collected in Costa Rica and French Guiana. Within

Costa Rica this species has been collected at: ALAJUELA, 20 km south of Upala; and LIMÓN, the Estrella Valley south of Limón; at Pandora (also within the Estrella Valley).

ALTITUDINAL DISTRIBUTION. — The Pandora locality is less than 200 m elevation, and the Upala site is also lowland.

ADULT FLIGHT PERIOD. — Both records from the southern Caribbean coast are from September; the Upala record is from February.

HABITAT PREFERENCE. — The Pandora collection was made on small understory saplings along a small stream in primary forest.

Leucochrysa (*Leucochrysa*) *pretiosa* Banks, 1910
(Figs. 60–62)

DIAGNOSIS. — This species is very similar to *Leucochrysa colombia*, except that *L. pretiosa* has a completely pale green pronotum, with most of the mesonotum darkened, a dark metascutum and pale metascutellum. The outer gradate crossveins of the forewing are extensively margined with dark markings, as are the apical forks at the wing margin, forming a dark transverse apical line.

GEOGRAPHICAL DISTRIBUTION. — This widespread Neotropical species is known from Mexico, Guatemala, Costa Rica, Panama, Colombia, Venezuela, and Ecuador. It is probably the mostly commonly collected species of *Leucochrysa* (*Leucochrysa*) in Costa Rica, and unlike other members of the subgenus can occasionally be found in substantial populations. Within Costa Rica this species has been collected at: ALAJUELA, 20 km south of Upala; 8 km south of Santa Cecilia, Pitilla Biological Station; CARTAGO, Turrialba; GUANACASTE, Santa Rosa National Park, Río San Josecito; HEREDIA, La Selva Biological Station, near Puerto Viejo; LIMÓN, Río Reventazon, Finca Hamburgo; Limón (Ciudad); Talamanca Mountains, Río Barbilla; Pandora; PUNTARENAS, Golfito; and SAN JOSÉ, San José.

ALTITUDINAL DISTRIBUTION. — Sea level to 960 m.

ADULT FLIGHT PERIOD. — Adults have been collected in all months except October and November.

HABITAT PREFERENCE. — This species was collected on understory saplings near a small stream in mature forest.

Leucochrysa (*Nodita*) Navás, 1916

This is a very large group of leucochrysines, with representatives found in virtually every tropical forest in the New World. They are characterized by a triangular intramedian cell in the forewing. Occasionally an individual specimen will have a quadrangular intramedian cell, creating confusion as to subgeneric placement, but this characteristic is normally stable. This subgenus is sometimes raised to generic rank. There are 120 recognized species distributed from the southern United States to Argentina, including 24 species recorded from Costa Rica. There is much unrecorded synonymy and many undescribed species.

KEY TO COSTA RICAN *LEUCOCHRYSA* (*NODITA*)

Note: This key uses non-genitalic states, whenever possible, so that both males and females can be used. Unfortunately, old faded specimens will not key out reliably, so that relatively fresh specimens are needed. Three pair of species in the key will come out together at couplet 6, 9, and 23. They can only be separated by study of the male genitalia.

1. Size large (forewing length 20 mm or more) . . . 2
1′. Size smaller (forewing length 18 mm or less) . . . 4

2(1). Medial yellow line on thorax and abdomen margined laterally by red; vertex with double red line on both sides (Fig. 89) . . . *L.* (*N.*) *egregia*
2′. Thorax and abdomen without medial yellow line margined laterally with red (Fig. 71); vertex with dark lines, but not double lines on both sides . . . 3

3(2′). Vertex with red pentagonal marking; gena red (Fig. 64); four dark spots on mesoscutum (Fig. 65) . . . *L.* (*N.*) *amazonica*
3′. Vertex with brown transverse line; gena pale (Fig. 115); mesoscutum without markings (Fig. 116) . . . *L.* (*N.*) *pallescens*

4(1′). Apex of hind wing dark (Fig. 117) . . . 5
4′. Apex of hind wing pale (Fig. 96) . . . 10

5(4). Maxillary palpi dark (Fig. 118) . . . 6
5′. Maxillary palpi pale (Fig. 79) . . . 8

6(5). Psm-Pscu crossveins all darkly margined (Fig. 117) . . . *L.* (*N.*) *postica*
6′. Psm-Pscu crossveins not darkly margined (Fig. 72) . . . 7

7(6′). Dorsal horns of male gonarcus absent; arcessus unipartite . . . *L.* (*N.*) *indiga*
7′. Dorsal horns of male gonarcus absent; arcessus tripartite . . . *L.* (*N.*) *askanes*

8(5′). Base of forewing costal vein dark; transverse reddish brown band below antennal bases interrupted medially . . . *L.* (*N.*) *antica*
8′. Base of forewing costal vein pale; transverse reddish brown band below antennal bases complete . . . 9

9(8′). Gonocornua of gonarcal complex flattened, broad . . . *L.* (*N.*) *cornesta*
9′. Gonocornua of gonarcal complex elongate, tapered to point . . . *L.* (*N.*) *lenora*

10(4′). Pronotum uniformly pale (Fig. 128) . . . 11
10′. Pronotum variably marked with red or brown (Fig. 86) . . . 12

11(10). Frons with transverse dark or red band (Fig. 127); gonarcus variously shaped, but without double dorsal lobes . . . *L.* (*N.*) *virginiae*
11′. Frons white, without transverse dark band (Fig. 124); gonarcus bearing double blunt dorsal lobes in addition to arcessus and sharply pointed entoprocesses . . . *L.* (*N.*) *serrei*

12(10′). Maxillary palpi pale . . . 17
12′. Maxillary palpi dark . . . 13

13(12′). Mesonotum with two dark medial spots . . . 14
13′. Mesonotum completely pale medially, or with thin transverse line across anterior margin . . . 15

14(13). Forewing length <15 mm; clypeus pale . . . *L.* (*N.*) *caucella*
14′. Forewing length >17 mm; clypeus dark . . . *L.* (*N.*) *superior*

15(13′). Complete transverse dark red band across frons beneath antennal bases; scape with ventral longitudinal dark stripe . . . . *L.* (*N.*) *duarte*
15′. Dark marks on frons confined to lateral areas near gena; scape completely pale ventrally 16

16(15′). Vertex completely pale; mesoscutum pale; mesoscutellum with dark lateral spots; scape dorsally with one stripe; pronotum without medial small spots . . . . *L.* (*N.*) *amistadensis*
16′. Vertex with V-shaped dark mark behind antennal bases; mesoscutum usually with thin transverse dark line along anterior margin; mesoscutellum completely pale; scape dorsally with two stripes; pronotum with pair of tiny medial spots, often linked to thin dark posterior line . . . . *L.* (*N.*) *lancala*

17(12). Thin dark line extends completely along anterior and lateral margins of pronotum . . . . *L.* (*N.*) *oenops*
17′. Dark markings on lateral margin of pronotum not extending to anterior margin 18

18(17′). Pronotum with two medial dark spots; mesonotum with two medial and two anterolateral dark spots . . . . *L.* (*N.*) *forcipata*
18′. Dark spots and stripes on pronotum confined to lateral margins; mesonotal markings restricted to lateral, anterior areas or all of mesonotum 19

19(18′). Frons and gena completely pale . . . . *L.* (*N.*) *compar*
19′. Frons with brown or red stripes or spots 20

20(19′). Basal 12 antennomeres very dark; pronotum with thin, very dark brown, lateral stripe . . . . *L.* (*N.*) *navasi*
20′. Basal 12 antennomeres pale yellow, or at most dorsal surface of first six antennomeres darkened; pronotal markings reddish brown, thick 21

21(20′). Frons with transverse dark stripe below antennal bases; basal six antennomeres dark dorsally; metascutellum dark . . . . *L.* (*N.*) *nigrovaria*
21′. Frons with dark spots laterally near gena; antennomeres completely pale; metascutellum pale or dark 22

22(21′). Pronotum with four reddish brown spots, two laterally on each side . . . . *L.* (*N.*) *laertes*
22′. Pronotum with one small reddish brown spot on each anterolateral margin 23

23 (22′). Male gonocornua present, long and thin . . . . *L.* (*N.*) *cortesi*
23′. Male gonocornua absent . . . . *L.* (*N.*) *ratcliffei*

Leucochrysa* (*Nodita*) *amazonica Navás, 1913
(Figs. 63–65)

DIAGNOSIS. — This is one of four large species of *Nodita* in Costa Rica with Rs darkened on the forewing at mid-length. There is a distinctive, red, pentagonal mark on the vertex and an arc of four red spots along the anterior margin of the mesoprescutum and mesoscutum.

GEOGRAPHICAL DISTRIBUTION. — This species was originally described from Brazil (Amapá, near the mouth of the Amazon River). Adams (1987) has recorded specimens from El Salvador, Honduras, Panama, and Guyana. Costa Rica records are from: ALAJUELA, Finca San Gabriel, 2 km southwest of Dos Rios; LIMÓN, Pandora; Hitoy-Cerere Biological Reserve.

ALTITUDINAL DISTRIBUTION. — Records from 40 to 600 m.

ADULT FLIGHT PERIOD. — March, May, and September.

HABITAT PREFERENCE. — The Pandora and Hitoy-Cerere specimens were collected along small streams in mature hillside forest on understory saplings.

Leucochrysa (*Nodita*) *amistadensis* Penny, 2001
(Figs. 66–68)

DIAGNOSIS. — This medium-sized species of *Nodita* has dark palpi with their apices pale; an elongate, dark genal stripe; pale apex to hind wing; a lateral red stripe on both sides of pronotum which expands beyond mid-length; dark spots at lateral margin of meso- and metascutella; and a darkened apex of male ninth tergite.

GEOGRAPHICAL DISTRIBUTION. — This species is only known from Costa Rica: PUNTARENAS, La Amistad National Park, Las Alturas.

ALTITUDINAL DISTRIBUTION. — 1500–1600 m.

ADULT FLIGHT PERIOD. — February.

HABITAT PREFERENCE. — Collected on understory saplings, including many *Peperonia* plants, in mixed montane primary forest with many large *Ficus* trees.

Leucochrysa (*Nodita*) *antica* Navás, 1913
(Figs. 69–71)

DIAGNOSIS. — This is one of three closely-related, medium-sized species of *Nodita* from Costa Rica in which the apex of the hind wing is darkened and a lateral red spot is present on both sides of the pronotum. All three have a curved red line around the anterior margin of the mesonotum and darkened forewing crossveins, often with margining, especially at the rhegma. All three species have the dorsal surface of the antennal scape reddened. This species can be separated from the other two by having two red spots on the frons directly beneath the antennae and having the dorsal red marks wrap around and cover the ventral surface of the scape.

GEOGRAPHICAL DISTRIBUTION. — The original description of this species indicated only Central America for its distribution. Within Costa Rica it has only been collected at: PUNTARENAS, La Amistad National Park, Las Alturas; Río Cotón.

ALTITUDINAL DISTRIBUTION. — 1500 m elevation.

ADULT FLIGHT PERIOD. — Late February to early March.

HABITAT PREFERENCE. — Collected on understory saplings, including many *Peperonia* plants, in mixed montane primary forest with many large *Ficus* trees.

Leucochrysa (*Nodita*) *askanes* (Banks, 1946)
(Figs. 72–74)

DIAGNOSIS. — This is one of two Costa Rican species of *L.* (*Nodita*) of medium-size that have the tips of the hind wings darkened and the posterior half of the pronotum bearing a red triangular mark laterally on both sides [the other species is *Leucochrysa* (*Nodita*) *postica*]. Other diagnostic characteristics include dark maxillary palpi, a transverse red stripe on the clypeus and crossveins that are not margined in the medial area of the forewing. The vertex bears a small red central spot.

GEOGRAPHICAL DISTRIBUTION. — This species has only been recorded from Costa Rica. Known localities are: CARTAGO, Turrialba; LIMÓN, 11.3 km (7 mi) north of Guácimo; Pandora; and PUNTARENAS, Monteverde.

ALTITUDINAL DISTRIBUTION. — Elevation ca. 40 m at Pandora to 1500 m at Monteverde.

ADULT FLIGHT PERIOD. — February, May, and September with the majority in September.

HABITAT PREFERENCE. — The Pandora locality is a mature wooded hillside with a small stream running through it. The specimens were collected on the foliage of young understory saplings near the stream. The Monteverde locality was a more open forest at the edge of a field with individuals again being found on foliage of understory saplings.

***Leucochrysa* (*Nodita*) *caucella* (Banks, 1910)**
(Figs. 75–77)

DIAGNOSIS. — This medium-sized species has a pale apex to the hind wing; a reddish brown triangular spot laterally on both sides on posterior half of the pronotum and a small reddish brown spot at its anterio-lateral margin; palpi are dark basally and pale at apex; small dark spot on gena; antennae pale with dorsal red stripe on scape; mesonotum with two red spots at junction of mesoprescutum and mesoscutum; forewing radials, gradates, and apical forks dark and with dark margining of gradate veins.

GEOGRAPHICAL DISTRIBUTION. — This species was previously known from Panama, Colombia, and Venezuela. Within Costa Rica it is known only from PUNTARENAS, La Amistad National Park, Las Alturas. This may be a northern South American species that reaches only into southernmost Costa Rica.

ALTITUDINAL DISTRIBUTION. — 1500–1600 m.

ADULT FLIGHT PERIOD. — February.

HABITAT PREFERENCE. — Collected on understory saplings, including many *Peperonia* plants, in mixed montane primary forest with many large *Ficus* trees.

***Leucochrysa* (*Nodita*) *compar* (Navás, 1921)**
(Figs. 78–80)

DIAGNOSIS. — This species has three distinctive characteristics: 1) most characteristic is the dark brown, basal, ten flagellar segments (apex of flagellum pale); 2) a dark brown, lateral scape stripe, and 3) a thin, dark brown, lateral pronotal stripe. These character states, together with completely pale frons, gena, and palps, make this species unique among Central American *Leucochrysa* (*Nodita*).

GEOGRAPHICAL DISTRIBUTION. — This species was described from Cuba and until now was known only from that country. Costa Rican specimens (all females) were collected at: ALAJUELA, 20 km south of Upala.

ALTITUDINAL DISTRIBUTION. — Unknown.

ADULT FLIGHT PERIOD. — Late December to early March.

HABITAT PREFERENCE. — This is a lowland species found in disturbed forest habitat.

REMARKS. — The normally dark spot on the forewing pterostigma is quite pale in this species, the antennae are only slightly longer than the forewing and the outer gradate series meets Psm at a rather wide angle, leading one to suspect that this may not be a species of Leucochrysini, but rather Chrysopini (*Ceraeochrysa* or *Chrysopodes*). Of the five specimens seen, all were females, so that male genitalia remain unstudied. Thus, this species is placed here only provisionally.

***Leucochrysa* (*Nodita*) *cornesta* Banks, 1944**
(Figs. 81–83)

DIAGNOSIS. — This is one of three, closely-related, medium-sized species of *L.* (*Nodita*) from Costa Rica with the apex of the hind wing darkened and a lateral red spot on both sides of the pronotum. All three species have a curved red line around the anterior margin of the mesonotum and darkened forewing crossveins, often with margining, especially at the rhegma, as well as the dorsal surface of the antennal scape reddened. *Leucochrysa* (*Nodita*) *cornesta* can be separated from the other two by possession of a complete transverse red line on the frons directly beneath the antennae. The ventral surface of the antennal scape is pale green.

GEOGRAPHICAL DISTRIBUTION. — This species has previously been known from Surinam and French Guiana. Within Costa Rica it has been taken at: LIMÓN, Pandora; Hitoy-Cerere Biological

Station; and PUNTARENAS, Isla. With only four records it is difficult to generalize, but this species may be limited to the southeastern part of the country.

ALTITUDINAL DISTRIBUTION. — Below 100 m elevation.

ADULT FLIGHT PERIOD. — March and September.

HABITAT PREFERENCE. — This species was collected resting on leaves of understory saplings in mature hillside forest along a small stream.

Leucochrysa (*Nodita*) *cortesi* Navás, 1913

DIAGNOSIS. — This is part of a closely-related group of species with pale maxillary palpi, pale apex of the hind wing, dark frontal markings, dark lateral markings on the pronotum, and meso- and metanota that gradually darken with age. Costa Rican species in this group include: *L.* (*N.*) *cortesi, L.* (*N.*) *laertes, L.* (*N.*) *navasi, L.* (*N.*) *nigrovaria,* and *L.* (*N.*) *ratcliffei.* The most closely-related species is *L.* (*N.*) *ratcliffei,* which shares with *L.* (*N.*) *cortesi* two dark, lateral, frontal spots rather than a transverse band, a dark spot at the anterolateral corner of the pronotum rather than a lateral stripe, and completely pale flagellum rather than having the base of the flagellum darkened. *Leucochrysa* (*N.*) *cortesi* can only be separated from *L.* (*N.*) *ratcliffei* by study of the male genitalia: *L.* (*N.*) *cortesi* has long, thin gonocornua that are completely absent in *L.* (*N.*) *ratcliffei.*

GEOGRAPHICAL DISTRIBUTION. — This species is recorded from Costa Rica, Mexico (Tabasco), Trinidad and Venezuela. Within Costa Rica it has been recorded from: LIMÓN: Hamburg Farm on the Reventazon (River), (Hamburg Museum—lost); between Limón and Las Mercedes, 12–30 km from the Atlantic Ocean (Hamburg Museum—lost) [as *L.* (*N.*) *nevermanni*]; SAN JOSÉ: Pedrogoso, D.C. Rounds, 1? (MCZ) [as *L.* (*N.*) *calverti*].

ALTITUDINAL DISTRIBUTION. — Sea level (near Limón) to 646 m (at Pedregoso).

ADULT FLIGHT PERIOD. — February, April, and June.

HABITAT PREFERENCE. — Unknown.

REMARKS. — *Leucochrysa* (*N.*) *calverti* and *L.* (*N.*) *nevermanni,* both described from Costa Rica, were synonymized with *L.* (*N.*) *cortesi* by Banks (1945).

Leucochrysa (*Nodita*) *duarte* Banks, 1946 [new combination]

(Figs. 84–86)

DIAGNOSIS. — This is one of three, medium-sized species of *L.* (*Nodita*) in Costa Rica with a pale apex to the hind wing, and red spots along the lateral margin of the pronotum. It can be separated from the other two by possession of pronotal spots on the posterior half of the pronotum. There is sometimes apparent a second pair of pronotal spots just under the anterio-lateral margin of the pronotum.

GEOGRAPHICAL DISTRIBUTION. — This species is only known from Costa Rica. Records include: LIMÓN, Pandora; Hitoy-Cerere Biological Station; and SAN JOSÉ, Pedregoso (holotype).

ALTITUDINAL DISTRIBUTION. — The Limón Province records are from an elevation of 15–220 m, while Pedregoso is in the central valley at mid-elevations (approximately 1000 m).

ADULT FLIGHT PERIOD. — February and March.

HABITAT PREFERENCE. — This species was collected resting on leaves of understory saplings in mature hillside forest along a small stream.

Leucochrysa (*Nodita*) *egregia* Navás, 1913

(Figs. 87–89)

DIAGNOSIS. — The large size, distinctive red spotting pattern on thorax and abdomen, double red stripe on vertex, and darkened focal area at mid-point of radial area all help to distinguish this species.

Geographical Distribution. — This species is known from Guatemala, Costa Rica, and Panama. Within Costa Rica specimens have been collected at: GUANACASTE, Finca La Pacifica, near Cañas; and PUNTARENAS, Monteverde.

Altitudinal Distribution. — Near sea level to 1500 m.

Adult Flight Period. — February and September.

Habitat Preference. — Specimens were collected at a light trap placed in front of the visitor center at Monteverde Biological Reserve in mature, moist forest. Individuals have also been collected in bushes near the river at La Pacifica.

Remarks. — *Leucochrysa* (*Nodita*) *luctuosa* Banks, 1914 is a **new synonym** of this species.

***Leucochrysa* (*Nodita*) *forcipata* Penny, 1998**
(Figs. 90–92)

Diagnosis. — This species has pale antennae, completely pale frons and gena, two dark spots on the pronotum and two additional dark spots on the mesonotum. The meso- and metascutella are both dark. There is a distinctive dark swelling of the first anal crossvein. However, the most characteristic feature of this species, and the one that gives it its name, is the double dorsal horns of the male gonarcus.

Geographical Distribution. — Currently, this species is known only from Costa Rica: SAN JOSÉ, El Salvage, Río Tabarcia, 8 km (road) E Palmichal (9.847°N, 84.164°W), 19–21 January 1992, Holzenthal, Kjer, and Quesada (UMIC).

Altitudinal Distribution. — 1650 m.

Adult Flight Period. — Known only from January.

Habitat Preference. — Unknown.

***Leucochrysa* (*Nodita*) *indiga* (Navás, 1928)**
(Figs. 93–95)

Diagnosis. — The most distinctive features of this species are: the dark tip of the hind wing, the dark transverse stripe across the lower part of the frons, the black palpi, the longitudinal dorso-lateral stripe on the scape, and the darkened first two antennal flagellomeres.

Leucochrysa (*Nodita*) *askanes*, *L.* (*N.*) *indiga*, and *L.* (*N.*) *postica* form a closely-related species-group with few external characters to separate them. However, *L.* (*N.*) *postica* does not have a small dark medial spot on the vertex and has extensive dark margining of the forewing inner gradate crossveins.

Leucochrysa (*Nodita*) *askanes* and *L.* (*N.*) *indiga* can only be told apart by characters of the male genitalia. *Leucochrysa* (*Nodita*) *indiga* lacks the elongate, apically-pointed endoprocesses of the gonarcus found in both *L.* (*N.*) *askanes* and *L.* (*N.*) *postica*.

Geographical Distribution. — Navás' original type was indicated as being from Costa Rica: SAN JOSÉ, San José. Penny (2001) designated a neotype from ALAJUELA, 20 km south of Upala. One additional locality is known from LIMÓN, Pandora.

Altitudinal Distribution. — Near sea level.

Adult Flight Period. — Late September to February.

Habitat Preference. — The specimen from Pandora was collected on understory saplings near a small stream in primary forest where the humidity was quite high and probably remained so the year round.

Leucochrysa (*Nodita*) *laertes* (Banks, 1946)

(Figs. 96–98)

Diagnosis. — This species has two red spots on the frons, often with a thin, inverted, V-shaped mark connecting them to the area between the antennal bases. There is a thin V-shaped mark on the vertex behind the antennal bases. A dorso-lateral dark stripe extends the length of the antennal scape and can, at times, apically cover the whole dorsal surface. The pronotum has a pair of reddish brown spots laterally on both sides, and pair of tiny brown spots medially. The mesonotum is dark laterally and this can extend along the anterior margin, although it is normally interrupted medially.

Geographical Distribution. — This species has been known only from Panama. Within Costa Rica this species has been collected only at ALAJUELA, 20 km south of Upala.

Altitudinal Distribution. — Lowlands near sea level.

Adult Flight Period. — Primarily in January, with one specimen collected in May.

Habitat Preference. — The only known collecting site from Costa Rica is heavily disturbed, lowland forest.

Leucochrysa (*Nodita*) *lafoni* Navás, 1911

This species was described from an unnamed locality in Costa Rica. The original description mentions a dark lateral spot on each side of the pronotum and a dark spot on each side of the mesoscutum. Several species would fit this description, including *L.* (*N.*) *clypsydra* Banks, 1918 from Colombia; *L.* (*N.*) *duarte* from Costa Rica; and *L.* (*N.*) *morenoi* (Navás, 1934) from Ecuador. The type (in the Paris Museum) has been eaten out by psocids, is discolored, and lacking an abdomen. At this time it is probably best to consider this species an *incertae sedis*.

Leucochrysa (*Nodita*) *lancala* Banks, 1944

(Figs. 99–101)

Diagnosis. — The most distinctive characteristics are: the double dark dorsal stripe on the scape; palpi dark externally; dark red spots on the frons adjacent to gena; dark red V-shaped mark posterior to antennal bases; dark red lateral pronotal stripe; and pair of tiny dark spots medially on the pronotum. *Leucochrysa* (*Nodita*) *laertes* has many of these features, such as dark spots on the frons, V-shaped dark mark posteriad to antennal bases; dark scape stripe; and tiny medial pair of spots on the pronotum, and the two species are probably closely related. However, they differ in that *L.* (*N.*) *laertes* has pale palpi, the dark marks on the frons are higher—closer to the antennal bases; the dark scape stripe is single and thick, often broader apically; and the hind wing apex is pale.

Geographical Distribution. — This species is known from Panama, Colombia, Venezuela and Surinam. Within Costa Rica it has been collected at: GUANACASTE, La Taboga Forest Reserve, 9 km south of Cañas, and La Pacifica, near Cañas.

Altitudinal Distribution. — Near sea level.

Adult Flight Period. — Early to mid-February.

Habitat Preference. — Specimens are from lowland, highly modified, riverine forest.

Leucochrysa (*Nodita*) *lenora* (Banks, 1944)

(Figs. 102–104)

Diagnosis. — This is one of three, closely-related, medium-sized species of *L.* (*Nodita*) from Costa Rica with the apex of the hind wing darkened and a lateral red spot on both sides of the pronotum. All three have a curved red line around the anterior margin of the mesonotum and darkened forewing crossveins, often with margining, especially at the rhegma. All three species also have the dorsal surface of the antennal scape reddened. This species can be separated from the other two by its having two red spots on the frons directly beneath the antennae and lacking red markings on the ventral surface of the antennal scape.

GEOGRAPHICAL DISTRIBUTION. — This species was originally described from Venezuela, Surinam, and Brazil. Costa Rican records include: ALAJUELA, 20 km south of Upala; HEREDIA, Chilamate; and LIMÓN, Pandora. This appears to be primarily a northern South American species, which ranges into southern Central America.

ALTITUDINAL DISTRIBUTION. — The Pandora record is from a hillside only about 40 m above sea level.

ADULT FLIGHT PERIOD. — All months of the year.

HABITAT PREFERENCE. — This species was collected resting on leaves of understory saplings in mature hillside forest along a small stream.

Leucochrysa (*Nodita*) *nativa* (Navás, 1911)

This Costa Rican species is rather large, with a forewing length of 17.5–18 mm. It is clearly a member of *Leucochrysa* (*Nodita*), but the original description is not very informative and the type is badly damaged. The specimen (MNHN, Paris) is badly discolored, the head is crushed, and it is covered with moth scales. It is best to consider it a *nomen dubium* at this time.

Leucochrysa (*Nodita*) *navasi* Kimmins, 1940

(Figs. 105–107)

DIAGNOSIS. — This is one of the medium-sized species of *L.* (*Nodita*) with pale palpi and pale apex to hind wing; a lateral dark stripe on pronotum which ends at anterlateral angle. This species can be separated from other species in this group by the small, reddish brown spot on frons below antenna; completely pale vertex; meso- and metanota completely pale; forewing veins darkened at mid-length of radius, on gradates and along apical forks.

GEOGRAPHICAL DISTRIBUTION. — This species was originally described from Mexico under the junior homonym *Nodita alternata*. There is an unpublished record from Honduras. Within Costa Rica it has been collected at: CARTAGO, Cachí; PUNTARENAS, La Amistad National Park, Las Alturas; Fila Cedra, near Las Alturas.

ALTITUDINAL DISTRIBUTION. — 1500–2000 m.

ADULT FLIGHT PERIOD. — February.

HABITAT PREFERENCE. — Collected on understory saplings, including many *Peperonia* plants, in mixed montane primary forest with many large *Ficus* trees.

Leucochrysa (*Nodita*) *nigrovaria* (Walker, 1853)

(Figs. 108–110)

DIAGNOSIS. — This medium-sized species has the apex of the hind wing pale; pale maxillary and labial palpi, a transverse dark stripe on the frons below the antennae; vertex bearing a red V-shaped mark behind the antennae; pale pronotum with dark lateral margin and variably darkened meso- and metanota. The antennae are dark basally and progressively paler after the basal six flagellomeres.

GEOGRAPHICAL DISTRIBUTION. — This species has been recorded from Colombia, Venezuela and Costa Rica (unnamed locality) under the name *L.* (*N.*) *ceratica*. The only other record is from: PUNTARENAS, La Amistad National Park, Las Alturas.

ALTITUDINAL DISTRIBUTION. — The Las Alturas record is from 1500 m elevation, and the area near San José is at mid-elevations (1000–1200 m).

ADULT FLIGHT PERIOD. — March.

HABITAT PREFERENCE. — Collected on understory saplings, including many *Peperonia* plants, in mixed montane primary forest with many large *Ficus* trees.

REMARKS. — This species has slowly developing, dark pigmentation on the meso- and metanota. The first dark pigment appears on the metascutellum, then progressively develops on the rest of the meso- and metanota. *Leucochrysa* (*N.*) *ceratica* (Navás, 1911) and *L.* (*N.*) *maculata* (Navás, 1928) are **new synonyms**.

***Leucochrysa* (*Nodita*) *oenops* Adams, 1987**

(Figs. 111–113)

DIAGNOSIS. — The most distinctive feature is a narrow dark ring around the lateral and anterior margins of the pronotum. Many other species have lateral stripes, but none extend fully around the anterior margin, as does this species. This is one of the medium-sized species of *Nodita* in Costa Rica with pale palpi and pale apex to the hind wing. Two other features help set this species apart from others: behind the antennae on the vertex are double V-shaped red marks followed by a triangular red central mark on the vertex. The mesonotum is variable, having at minimum a pair of anterior dark spots and maximally having the whole mesonotum darkened.

GEOGRAPHICAL DISTRIBUTION. — At present this species is only known from Nicaragua and Costa Rica. Costa Rican records include: GUANACASTE, La Taboga Forest Reserve, 9 km south of Cañas; 14 km south of Cañas; Finca La Pacifica, near Cañas; Santa Rosa National Park; and LIMÓN, Pandora.

ALTITUDINAL DISTRIBUTION. — All known localities are lowland, with the Pandora locality at about 40 m.

ADULT FLIGHT PERIOD. — March, May, and September.

HABITAT PREFERENCE. — Individuals of this species were collected resting on leaves of understory saplings in mature hillside forest along a small stream at Pandora. Other individuals were collected in bushes near a river at La Pacifica.

***Leucochrysa* (*Nodita*) *pallescens* Banks, 1946**

(Figs. 114–116)

DIAGNOSIS. — This is one of the four large species of *L.* (*Nodita*) in Costa Rica with a dark focal area in the radial area of the forewing. There is a thin, dark, V-shaped marking on the vertex behind the antennae and only occasional, very small markings on the thorax; an occasional small, dark right-angled mark at the posterior part of the pronotum and a thin dark line tranversely across the anterior mesoscutum.

GEOGRAPHICAL DISTRIBUTION. — This species is only known from Guatemala and Costa Rica. Within Costa Rica it is known only from: LIMÓN, Pandora.

ALTITUDINAL DISTRIBUTION. — Pandora is only about 40 m above sea level.

ADULT FLIGHT PERIOD. — September.

HABITAT PREFERENCE. — The Pandora specimen was collected on understory saplings in mature hillside forest along a small stream.

Leucochrysa* (*Nodita*) *postica Navás, 1913
(Figs. 117–119)

DIAGNOSIS. — This is one of two medium-sized species of *L.* (*Nodita*) with a darkened hind wing tip and a triangular red mark laterally on both sides of the posterior half of the pronotum [the other is *Leucochrysa* (*Nodita*) *indiga*]. The maxillary palpi are dark; the clypeus bears a transverse red stripe; and the m-cu crossveins are margined in the forewing. The vertex is completely pale green.

GEOGRAPHICAL DISTRIBUTION. — This species has previously been reported from Surinam and French Guiana. Within Costa Rica, records are from: ALAJUELA, 20 km south of Upala; GUANACASTE, 20 km southwest of Cañas; HEREDIA, La Selva Biological Station, near Puerto Viejo; LIMÓN, Hitoy-Cerere Biological Reserve; and PUNTARENAS, 16.1 km (10 mi) S Rincon de Osa.

ALTITUDINAL DISTRIBUTION. — Below 200 m.

ADULT FLIGHT PERIOD. — Most records (n = 10) are from February to May, but there is one record from September.

HABITAT PREFERENCE. — The collections made at Hitoy-Cerere Biological Reserve were on understory saplings in mature hillside forest along a small stream.

***Leucochrysa* (*Nodita*) *ratcliffei* Penny, 2001**
(Figs. 120–122)

DIAGNOSIS. — This is a medium-sized species of *L.* (*Nodita*) with pale hind wing apex; pale palpi; small brown spot on frons between gena and antennal base; dark spot on vertex at dorsal base of antenna; small brown spot at anterio-lateral margin of pronotum; dark arc along anterior margin of mesonotum; forewing gradates, apical forks, and rhegmal spot darkened and margined.

GEOGRAPHICAL DISTRIBUTION. — Known only from Costa Rica. Within the country it has been collected at: LIMÓN, Pandora; and PUNTARENAS, Las Cruces, near San Vito.

ALTITUDINAL DISTRIBUTION. — The Pandora record is from lowland hillside at about 100 m elevation, while the Las Cruces records are from near 1800 m elevation.

ADULT FLIGHT PERIOD. — March and September.

HABITAT PREFERENCE. — Individuals of this species were collected resting on leaves of understory saplings in mature hillside forest along a small stream.

***Leucochrysa* (*Nodita*) *serrei* (Navás, 1923)**
(Figs. 123–125)

DIAGNOSIS. — This medium-sized species' most notable characteristics are the pale green, unmarked pronotum and the reddish dorsal surface of the antennal scape. No other species of *L.* (*Nodita*) in Costa Rica has an unmarked pronotum. The male gentialia also have a distinctive pair of dorsal horns on the arcessus, which are blunt-tipped with a U-shaped incision between them.

GEOGRAPHICAL DISTRIBUTION. — This species has only been collected in Costa Rica. The records are: GUANACASTE, 14 km south of Cañas; San Gabriel; Maritza Biological Station, west side of Orosí Vulcano; SAN JOSÉ, San José.

ALTITUDINAL DISTRIBUTION. — 600 m.

ADULT FLIGHT PERIOD. — March and July.

HABITAT PREFERENCE. — Unknown.

Leucochrysa (*Nodita*) *superior* Navás, 1913

Diagnosis: This is a fairly large species with dark maxillary palpi, dark clypeus, dark lateral margins of pronotum, and two mesonotal spots. The most similar species is *L.* (*N.*) *caucella*, which can be separated by its smaller size and pale clypeus.

Geographical Distribution. — The type is from Guatemala. Navás (1928) reported this species from COSTA RICA: LIMÓN, between Limón and Las Mercedes, 12–30 km from the Atlantic Ocean (Hamburg Museum—lost).

Altitudinal Distribution. — Sea level.

Adult Flight Period. — November.

Habitat Preference. — Unknown.

Remarks. — This is a poorly known species, with a single, somewhat dubious record from Costa Rica. The type is teneral and may not display the full coloration of a mature individual.

Leucochrysa (*Nodita*) *virginiae* Penny, 1998

(Figs. 126–128)

Diagnosis. — This medium-sized species has the apex of the hind wing pale; pale maxillary and labial palpi; a completely red frons; pale vertex; pale pronotum and metanotum.

Geographical Distribution. — This species has only been collected in Costa Rica. The only record is from: LIMÓN, Hitoy-Cerere Biological Reserve.

Altitudinal Distribution. — 220 m.

Adult Flight Period. — March.

Habitat Preference. — This species was collected resting on leaves of understory saplings in mature hillside forest along a small stream.

Vieira Navás, 1913

This is one of the most distinctive of chrysopid genera. In addition to being among the largest in size and having a very characteristic dark pigmentation pattern on the wings, the costal area of the forewings is very broad with sinuous basal crossveins. This is the only genus with costal crossveins of this form.

There are currently two recognized species in the genus, but they are possibly synonymous (Brooks and Barnard 1990). There is an additional undescribed species in northern South America. The genus ranges from Mato Grosso State in west central Brazil to Costa Rica. One species, *Vieira leschnaulti*, has been collected in Costa Rica.

Vieira leschnaulti (Navás, 1911)

(Figs. 129–131)

Diagnosis. — The large size, extensively pigmented forewings, and sinuous basal costal veins serve to distinguish this species from other Chrysopidae found in Costa Rica.

Geographical Distribution. — This species was originally described from French Guiana, and has been found from Costa Rica and Surinam south to west central Brazil, Peru and Bolivia. Within Costa Rica, only three collections are known: CARTAGO, Centro Agronómico Tropical de Investigación y Enseñanza (C.A.T.I.E.), 2 km southwest of Turrialba (twice); and LIMÓN, Cerro Cocori, Finca de E. Rojas.

Altitudinal Distribution. — Unknown.

ADULT FLIGHT PERIOD. — The collections at C.A.T.I.E. were in late May and late June while the Cerro Cocori specimen was collected in February.

HABITAT PREFERENCE. — The specific habitat where the Costa Rican specimens were collected is unknown, but in the central Amazon Region a specimen was collected on understory vegetation in a mature forest.

NOTE. — It is probably a coincidence that the two largest and most colorful species of New World chrysopids, *Loyola croesus* and *Vieira leschnaulti*, are both seldom collected, yet within Costa Rica both have been collected in the immediate vicinity of Turrialba during May and June.

TRIBE BELONOPTERYGINI

This group of green lacewings is very robust, with broad bodies, pronota that are wider than long, and very stout antennae with flagellar segments wider than long. Very little is known of the biology of this tribe, but where life history has been studied, the larvae are always associated with ant nests. One blue-colored larva of *Nacarina* was encountered in the nest of *Camponotus* ants in Guyana. The Old World genus *Italochrysa* is speciose, but in the Western Hemisphere there are only three genera and 16 known species (Brooks and Barnard 1990). The latter range from Cuba and the southeastern United States to northern Argentina. Only *Nacarina* has been recorded from Costa Rica.

Nacarina Navás, 1915

Nacarina is easily separated from the other two New World genera of Belonopterygini by the absence of dark brown or black pigmentation on the body and wings (as in *Abachrysa*) and having neither the narrow wings, nor the longitudinal red stripe of the forewing, of *Belonopteryx*. *Nacarina* contains 14 of the 16 known species of New World Belonopterygini. They are found over the same range as the tribe in the New World, that is, from the southeastern United States to Argentina. Three species have been collected in Costa Rica.

KEY TO COSTA RICAN *NACARINA*

1. Three rows of gradate crossveins in forewing; forewing >30 mm in length . . . . *N. titan*
1′. Two rows of gradate crossveins in forewing; forewing <30 mm in length 2

2(1′). Antennae entirely very dark; body brown and forewing longitudinal veins black . . . . *N. megaptera*
2′. Antennae pale or possibly with exterior dark stripe; body green, with forewing longitudinal veins green (some crossveins dark). . . . . *N. cordillera*

Nacarina cordillera (Banks, 1910)
(Figs. 132–134)

DIAGNOSIS. — This is the most common species of *Nacarina* in Costa Rica, and perhaps in the New World. It is frequently attracted to lights and often appears in collections. Only recently was the synonymy with *N. balboana* recognized and most identified specimens used the latter name. This species has a pale green body and wings with some crossveins darkened, and antennae pale (often with dark lateral stripe), with only two rows of gradate crossveins. The male ninth sternite has an apico-medial protuberance.

GEOGRAPHICAL DISTRIBUTION. — This species is known from southern Mexico, El Salvador, Costa Rica, Panama, Colombia, Venezuela, and western Brazil (Rondônia). Within Costa Rica this species appears to be commonly distributed in all lowland areas of the country and is readily attracted to lights. It has been collected at: ALAJUELA, Fábio Baudrit M. Agricultural Experiment Station;

CARTAGO, 7 km east of Moravia; Turrialba; Playa del Coco; 2 km southeast of Tuís; GUANACASTE, Santa Rosa National Park (PNSR), Río Cuajiniquil; PNSR, Río Poza Salada; PNSR, Quebrada Guacimo; PNSR, Quebrada Pedregal; PNSR, Agua Buena; Cerro El Hacha; west side of Orosí Vulcano, Maritza Biological Station; La Pacifica, 6 km north of Cañas; Murciélago Biological Station, 8 km southwest of Cuajiniquil; Pitilla Biological Station, 9 km south of Santa Cecilia; Palo Verde Biological Station, Palo Verde National Park; Barra Honda National Park, 3 km northwest of Nacaome; Las Pailas Biological Station, Rincón de la Vieja National Park; Finca Jenny, 30 km north of Liberia; HEREDIA, Magsasay Biological Station, Braulio-Carrillo National Park; LIMÓN, Finca E. Rojas, Cerro Cocori Sector; Cuatra Esquinas Biological Station, Tortuguero National Park; Cerro Tortuguero, Tortuguero National Park; Hitoy-Cerere Biological Station, Hitoy-Cerere Biological Reserve; Estrella Valley, Hitoy-Cerere Biological Reserve; Manzanillo, Gandoca y Manzanillo National Wildlife Refuge; Río Sardinas, Barra del Colorado National Wildlife Refuge; PUNTARENAS, Quebrada Bonita Biological Station, Carara Biological Reserve; Quepos, Manuel Antonio National Park; Rancho Quemado, Osa Peninsula; Bosque Esquinas, Osa Peninsula.

ALTITUDINAL DISTRIBUTION. — Sea level to 1050 m, but most common at lower elevations.

ADULT FLIGHT PERIOD. — January to July.

HABITAT PREFERENCE. — Collection records from Costa Rica indicate dry, semiarid environments, while Brazilian records indicate heavily disturbed pasture lands.

Nacarina megaptera (Navás, 1927)
(Figs. 135–137)

DIAGNOSIS. — This species is recognized by the completely dark antennae, brownish body, dark wing venation and two rows of gradate veins. The male ectoproct is ventrally pointed.

GEOGRAPHICAL DISTRIBUTION. — Originally described from Brazil, this species is also known from Costa Rica and Guyana. Within Costa Rica it has been collected at: GUANACASTE, Las Pailas Biological Station, Rincón de la Vieja National Park; Agua Buena, Guanacaste National Park; HEREDIA, Magsasay Biological Station, Braulio-Carrillo National Park; LIMÓN, Tortuguero National Park, 3.5 km south of Tortuguero; Río Sardinas, Barra del Colorado Wildlife Reserve; Hitoy-Cerere Biological Reserve; PUNTARENAS, Carara Biological Reserve (RBC), Quebrada Bonita Biological Station; RBC, El Chuzazo; Corcovado National Park, Piedra el Arco; Quepos, Manuel Antonio National Park; Esquinas Biological Station, Osa Peninsula. It appears to be frequently attracted to lights at Manuel Antonio National Park, especially during April.

ALTITUDINAL DISTRIBUTION. — Sea level to 800 m.

ADULT FLIGHT PERIOD. — Collection records exist for almost all months of the year, but are concentrated in two modalities from February to June, and August to December.

HABITAT PREFERENCE. — This species appears to be taken at lights in the same habitat with *N. cordillera*.

Nacarina titan **Banks, 1915**
(Figs. 138–140)

DIAGNOSIS. — This species is characterized by its very large size (more than 30 mm forewing length), pale coloration, and disorganized third (middle) row of gradate crossveins. The pronotum has spots rather than stripes. The male ninth sternite bears apically a bifurcate protuberance.

GEOGRAPHICAL DISTRIBUTION. — The type specimen of *Nacarina titan* was collected, at Costa Rica: LIMÓN, Limón. A second specimen is known from Hitoy-Cerere Biological Reserve, south of the town of Limón.

ALTITUDINAL DISTRIBUTION. — The port city of Limón is close to sea level. The specimen from Hitoy-Cerere Reserve was collected at 200 m elevation.

ADULT FLIGHT PERIOD. — Collection dates are late May and December.

HABITAT PREFERENCE. — Unknown.

TRIBE CHRYSOPINI

This is the predominant group of green lacewings in the world, and perhaps the largest tribe of all neuropterans. They are ubiquitous in temperate regions where they sometimes go by the names of golden-eyes, or stink bugs, although the term "stink bugs" is more correctly reserved for the hemipteran family Pentatomidae. They have been reared for mass introductions as biological control agents in fields and orchards. Chrysopines have been largely replaced in the New World tropical forests by leucochrysines, but they remain dominant in tropical open areas, including most agricultural lands. There are 32 known genera of Chrysopini worldwide, five of which are found in Costa Rica.

***Ceraeochrysa* Adams, 1982a**

Ceraeochrysa is a New World genus of chrysopine green lacewings containing about 50 species (see Adams 1982a). Although several species are known from temperate areas, most species are tropical. Costa Rica has a very rich assemblage of this genus, with 20 known species found within its borders. They are one of the most commonly encountered groups of green lacewings in the New World tropics. The habitat is open areas, such as grasslands, orchards, plantations, urban areas and cultivated plots, and they are seldom found in deep forest. Because of their presence in agricultural habitats, many species have good potential as biological control agents.

In general habitus they are medium-sized (about 10–15 mm in forewing length) with relatively narrow wings bearing little or no dark pigmentation on the membrane. However, the head and thorax are often brightly patterned in red or brown on a pale green background. Most Costa Rican species have a lateral longitudinal stripe on the pronotum, although some species have lateral spots on the pronotum. Unfortunately, the subcutananeous pigments break down rather easily and quickly after death, so that most specimens that have been exposed to light, heat, or chemicals for any length of time bear little resemblance to the colorful live adult.

The most characteristic feature of this genus is the very elongate gonapsis of the male genitalia. Except for a few species of *Chrysopodes* with short, broad gonapses, no other New World chrysopids have this distinctive form of genital armature.

Larvae of this genus are known to be trash carriers. That is, they place debris and the dried bodies of their prey over their own bodies, which are modified with long setae to hold the trash.

KEY TO COSTA RICAN *CERAEOCHRYSA*

1.	Lateral surface of pronotum with spots; antennae and palpi pale	2
1′.	Pronotum with lateral stripes; antennae and palpi variable	8
2(1).	Mesoscutum with two dark central spots	5
2′.	Mesoscutum completely pale	3
3(2′).	Forewing venation without swollen, heavily margined areas	4
3′.	Forewing with swollen and darkly margined 2A-3A crossvein and apex of CuP	*C. tauberae*
4(3).	One large dark spot anterior to mid-length on each side of pronotum	*C. costaricensis*
4′.	Two large dark spots on each side of pronotum, one of these at posterio-lateral angle	*C. defreitasi*

5(2). Metanotum with a pair of dark spots; apex of forewing CuP swollen, darkened 6
5′. Metanotum pale, without dark markings; apex of forewing CuP not swollen 7

6(5). Antennal scape without a dark stripe; vertex not darkened; apical tarsal segment dark . . . . *C. nigripedis*
6′. Antennal scape with a dark stripe dorsally; vertex darkened medially; apical tarsal segment pale . . . . *C. elegans*

7(5′). Two pairs of dark lateral pronotal spots; forewing crossvein 2A-3A not swollen and darkened . . . . . . *C. inbio*
7′. One pair of dark lateral pronotal spots; forewing crossvein 2A-3A swollen and darkened . . . . *C. discolor*

8(1′). Inner gradate series of forewing bearing a small reticulate mosaic of cells surrounded by darkened membrane . . . . *C. pseudovaricosa*
8′. Inner gradate series normal, with stepwise series of veins, without reticulate mosaic of small cells 9

9(8′). Base of antennal flagellum pale on dorsal surface 10
9′. Base of antennal flagellum dark on dorsal surface 13

10(9). Pronotal stripes narrow, only slightly wider than antennal flagellum; two narrow dorsal stripes on antennal scape . . . . (continue only with males) 11
10′. Pronotal stripes broad, two to three times as wide as antennal flagellum; a single dorsal or lateral stripe on antennal scape . . . (continue only with males) 12

11(10). Male ninth sternite forming a recurved apical horn juxtaposed against numerous stout denticles ventrad of gonapsis . . . . *C. arioles*
11′. Male ninth sternite not recurved dorsally as an apical horn . . . . *C. cincta*

12(10′). Male abdomen with very enlarged spiracles; dorsolateral lobe absent from ninth sternite, but apex bifurcate and dentate, with additional spines lateral to apex of gonapsis; dorsal lobe of gonarcus singular, medial . . . *C. cubana*
12′. Male abdomen bearing normal spiracles; dorsolateral lobe present on ninth sternite, apex rounded with paired elongate ridges on membrane above ninth sternite; dorsal lobe of gonarcus paired, caudally recurved . . *C. valida*

13(9′). Dorsal surface of antennal scape completely red; vertex at base of antennal scapewith broadly triangular red mark . . . . *C. smithi*
13′. Dorsal surface of antennal scape pale or with longitudinal stripes, but not completely red; antennal marks may extend onto vertex as thin stripe, but not as broadly triangular mark 14

14(13′). Dark genal line present between compound eye and labrum 15
14′. Genal area below eye pale or with only a diffuse red tinge . . . . (continue only with males) 16

15(14). Pronotal stripe reddish brown; marginal forks of forewing pale green; pterostigma completely pale green to yellow; setae on male ectoproct slender, not stalked; gonarcus with medial hood . . . . *C. everes*
15′. Pronotal stripe chocolate brown; marginal forks of forewing darkened; pterostigma with slight darkening anteriorly; setae on male ectoproct thickened, stalked; gonarcus without medial hood . . . . *C. berlandi*

16(14′). Dorsal apodeme of male ectoproct with ventral anvil-shaped expansion . . . . *C. acmon*
16′. Dorsal apodeme of male ectoproct without ventral anvil-shaped expansion 17

17(16′). Pronotal stripes much broader than antennal flagellum; male ninth sternite with dorsolateral projection and two parallel ridges on membrane above apex; male genitalia with heavily sclerotized teeth on gonosaccus and broad entoprocesses which taper rapidly at apex . . . . *C. sanchezi*
17′. Pronotal stripes about same width as antennal flagellum; male ninth sternite without dorsolateral projection or parallel ridges above apex; male genitalia without stout teeth on gonosaccus 18

18(17′). Antennal scape with dorsolateral stripe half as wide as long . . . . *C. caligata*
18′. Antennal scape with one dorsal and often one lateral stripe one-quarter as wide as long 19

19(18′). Pronotal stripe brown; outer gradate series of forewing with seven or fewer crossveins; head yellow, distinctly contrasting with green pronotum . . . . *C. claveri*
19′. Pronotal stripe red; outer gradate series of forewing with nine or more crossveins; head and pronotum concolorous . . . . *C. gradata*

Ceraeochrysa acmon Penny, 1998
(Figs. 141–146)

DIAGNOSIS. — This species is similar to several other Costa Rican species of *Ceraeochrysa* with dark antennae and lateral red stripe on the pronotum. The most distinctive feature is the anvil-shaped ventral extension of the dorsal apodeme of the male terminalia. Identification without resort to study of the male terminalia is not reliable.

GEOGRAPHICAL DISTRIBUTION. — *Ceraeochrysa acmon* has, until now, only been recorded from Costa Rica, Panama, and Brazil. Within Costa Rica, this species is known from the holotype at: LIMÓN: Amubri, A. C. Amistad, UTM coordinates L-S 385500, 578000, 70 m, 4–21 December 1993, G. Gallardo, 1 male (INBIO), and GUANACASTE, Santa Rosa National Park.

ALTITUDINAL DISTRIBUTION. — This appears to be a lowland species. The record from Amubri was only 70 m and Santa Rosa National Park is near sea level. The site near Ariquemes in Brazil is at about 200 m elevation.

ADULT FLIGHT PERIOD. — In Costa Rica specimens were collected in April and December, but specimens from Panama were collected in May, and Brazilian specimens in October and November.

HABITAT PREFERENCE. — The site where this species was collected near Ariquemes in Brazil is secondary forest and abandoned plantations. There is also pasture land nearby. Santa Rosa National Park is primarily dry, deciduous tropical forest.

Ceraeochrysa arioles (Banks, 1944)
(Figs. 147–152)

DIAGNOSIS. — This species has pale labial palpi and antennae; two dorsal red stripes on antennal scape; pronotal stripes red and narrow; forewing gradates dark—3 inner gradates and 5 outer gradates. The most characteristic feature is the male terminalia, which includes a unique, recurved horn at the apex of the ninth sternite.

GEOGRAPHICAL DISTRIBUTION. — This species was originally described from San José, Costa Rica (Navás 1928). In the literature this species has been recorded from Mexico (Chiapas, Nuevo Leon, and Sinaloa), Honduras, Guatemala, and Trinidad under the names *C. binaria* and *C. arioles*. There is a female specimen determined by Nathan Banks from Guyana in the Field Museum (Chicago), although females are currently inseparable from *C. cincta* and *C. caligata*, and earlier records based on females must be viewed with much caution. At the time Adams (1982a) erected the genus *Ceraeochrysa* he designated a neotype for this species from Chiapas, Mexico. There is, in the Utah State University and California Academy of Sciences, a series of specimens collected at SAN JOSÉ: Escazú, a suburb of Costa Rica's capital city.

ALTITUDINAL DISTRIBUTION. — The elevation of Escazú is 1100 m.

ADULT FLIGHT PERIOD. — The Escazú specimens were collected during the months of January, April, May, and July.

HABITAT PREFERENCE. — Collections from the urban Escazú site indicate an open, disturbed habitat preference.

REMARKS. — This species was originally described as *Chrysopa binaria* Navás 1928 (a junior homonym of *Chrysopa binaria* Navás 1923) from San José, Costa Rica. The type was deposited in the Hamburg Museum and subsequently destroyed during WWII. Banks (1944) recognized the homonymy and created the name *Chrysopa arioles*.

Ceraeochrysa berlandi (Navás, 1924)

(Figs. 153–158)

DIAGNOSIS. — This is a member of the *lineaticornis* group of species with dark antennae, dark brown lateral scape stripe, a thin dark lateral stripe on the pronotum, and male terminalia containing an elongate, apically tripartite mediuncus, apically tapered ectoproct, gonapsis that is apically bifurcate, and a pair of erect, elongate gonocornu at the base of the mediuncus.

This species can be separated from other members of this group by the thickened setal bases at the apex of the ectoproct and the extremely thickened setal bases apically on the ninth sternite. This is one of two known species of *Ceraeochrysa* in Costa Rica with heavily margined forewing crossveins (the other being *C. gradata*). Additional characters include a dark brown genal spot, pale palpi, a dark brown lateral stripe on the antennal scape, and the first 10 to 12 antennal flagellomeres dark; apical antennal flagellomeres pale. The most distinctive features are the sclerites of the male genital armature, including: chalazate setae at the apex of the ectoprocts and ninth sternum; large, strongly curved entoprocesses; and two large lateral patches of gonosetae.

GEOGRAPHICAL DISTRIBUTION. — This species was described from Costa Rica, without specific locality information. There is a specimen in the Museum of Comparative Zoology, Harvard University from Mexico (Chiapas). Within Costa Rica specimens are known from CARTAGO, Tapantí National Wildlife Refuge; and PUNTARENAS, Osa Peninsula, Rancho Quemado.

ALTITUDINAL DISTRIBUTION. — Mid-elevation at Tapantí to low elevation at Rancho Quemado.

ADULT FLIGHT PERIOD. — Both records from Costa Rica are from January.

HABITAT PREFERENCE. — Unknown.

Ceraeochrysa caligata (Banks, 1946)

(Figs. 159–164)

DIAGNOSIS. — This is one of the species of *Ceraeochrysa* with pale antennae. It has a relatively narrow pronotal stripe and narrow stripe dorsally on scape. This species is most closely related to *C. cincta* and can be separated from it most easily by studying the male genitalia which have longer lateral arms of the gonarcus and the gonocornu are much longer than the mediuncus horns.

GEOGRAPHICAL DISTRIBUTION. — This species was originally described from Panama. Adams and Penny (1987) reported this species from the Amazon Basin of Brazil. Within Costa Rica *C. caligata* is known from GUANACASTE: 8 km (5 mi) NE Cañas; Finca La Pacifica..

ALTITUDINAL DISTRIBUTION. — Lowland areas below 200 m.

ADULT FLIGHT PERIOD. — Late December and early February.

HABITAT PREFERENCE: Two males were collected in bushes near a river in early February.

Ceraeochrysa cincta (Schneider, 1851)

(Figs. 165–170)

DIAGNOSIS. — As with *C. caligata* and *C. arioles*, this species has pale labial palpi, pale antennae, red stripe dorsally on antennal scape; and narrow red pronotal stripe. The male genitalia bear a rather curved ninth tergite apodeme, short entoprocesses, and short gonocornu.

GEOGRAPHICAL DISTRIBUTION. — This species was originally described from Brazil, and Adams and Penny (1987) recorded it from the southern United States, Mexico, Cuba, Guatemala, Panama, Galapagos Islands, Guyana, Surinam, Peru, Uruguay, and Argentina. It has also been collected frequently in northern Costa Rica from: ALAJUELA: 20 km S Upala; and GUANACASTE: 14 km S Cañas, 8 km (5 mi) NE Cañas, 3 km SE Rió Naranjo.

ALTITUDINAL DISTRIBUTION. — In Costa Rica known only from below 200 m.

ADULT FLIGHT PERIOD. — A possible emergence peak from October to April. This is the driest time of year for most of Costa Rica.

HABITAT PREFERENCE. — Known records in Costa Rica are from the lowland farming areas and disturbed secondary forest. Near Cañas, in February, several adults of this species were found resting on bushes near a river.

Ceraeochrysa claveri (Navás, 1911)

(Figs. 171–176)

DIAGNOSIS. — This species has pale palpi and very dark antennae. There is a double stripe on the antennal scape but it is placed dorsolaterally, so that the most lateral stripe is on the lateral surface. The pronotal stripe is narrow and brown. There are three to four inner and six to seven outer gradate veins in the forewing. The male terminalia have a curved hook on the ectoproct apodeme and there is a distinctive bifurcated apex to the male gonapsis.

GEOGRAPHICAL DISTRIBUTION. — Adams and Penny (1987) record this species from Mexico, Cuba, Haiti, Puerto Rico, Guatemala, Honduras, Panama, Colombia, Trinidad, Guyana, Surinam and Brazil. Within Costa Rica this species has been collected at: CARTAGO, Rancho Naturalista, NE Tuís; GUANACASTE, 8 km (5 mi) NE Cañas; HEREDIA, Puerto Viejo, Río Sarapiqui, Finca La Selva; and LIMÓN, Sector Cerro Cocori, Finca de E. Rojas; and Pandora.

ALTITUDINAL DISTRIBUTION. — 100 to 150 m in the lowlands, and somewhat higher elevations at Rancho Naturalista.

ADULT FLIGHT PERIOD. — February, June, September, and December in Costa Rica.

HABITAT PREFERENCE. — *Ceraeochrysa claveri* was attracted to lights near residences in an open area with many ornamental plants and virtually surrounded by banana plantations.

Ceraeochrysa costaricensis Penny, 1997

(Figs. 177–182)

DIAGNOSIS. — This species has pale green to yellow features, except for a pair of dark spots on the pronotum. In this respect it differs from other species of *Ceraeochrysa* with a spotted pronotum, in that they have four spots on the pronotum and dark spots on the mesoscutum and sometimes metascutum. In addition, there is no swelling and darkening of veins at the apex of the posterior cubitus of the forewing. The male genitalia indicate a close relationship with *C. everes*, which has a longitudinal red stripe laterally on both sides of the pronotum.

GEOGRAPHICAL DISTRIBUTION. — This species is known from the type male collected at Costa Rica: PUNTARENAS, Los Alturas, 27 February 1991, Helen Sparrow (INBIO); and Las Cruces, 6 km S San Vito.

ALTITUDINAL DISTRIBUTION: 1360 m.

ADULT FLIGHT PERIOD. — Late February and late September to early October.

HABITAT PREFERENCE. — The holotype specimen was attracted to a kerosene lamp inside a building at Los Alturas. The surrounding area is almost entirely disturbed, cultivated land, including ornamental trees around homes and orchards. The Las Cruces locality is the Wilson Botanical Garden only a few kilometers from the type locality.

Ceraeochrysa cubana (Hagen, 1861)

(Figs. 183–188)

DIAGNOSIS. — Labial palpi dark apically. Frons very pale, almost white. Antennae pale, with a single red line on dorsal surface of scape. Pronotal red stripe broad. All forewing crossveins very dark, including gradates. Three to four inner and four outer gradate veins. Males with extremely large abdominal spiracles. Male terminalia distinctive, with a knob at the apex of the gonapsis, large lateral gonocristae, as well as long, dense gonosetae on the gonosaccus.

GEOGRAPHICAL DISTRIBUTION. — Adams and Penny (1987) record this species from the southern U.S.A., Mexico, Cayman Islands, Cuba, Jamaica, Haiti, Puerto Rico, Barbados, Honduras, Venezuela, Guyana, Surinam, and Brazil. Within Costa Rica it has been recorded from: ALAJUELA: 20 km S Upala; CARTAGO: Turrialba (C.A.T.I.E.), GUANACASTE: 14 km S Cañas.

ALTITUDINAL DISTRIBUTION. — Unknown.

ADULT FLIGHT PERIOD. — January to April, June, November, and December.

HABITAT PREFERENCE. — Adams and Penny (1987) mention this species being abundant on hedgerows of native vegetation and occasionally citrus trees in Honduras.

Ceraeochrysa defreitasi Penny, new species
(Figs. 189–195)

HOLOTYPE. — Male, "Finca Las Cruces near San/ Vito, Puntarenas Province, Costa Rica, 1800 m elev./ 14.III.69 at black light/ Joe Sheldon #1969-142." Holotype deposited in the Entomology Collection of the California Academy of Sciences, San Francisco. Two male paratypes, same data as holotype except 15.III.69, #1969-151 and #1969-154. One deposited at California Academy of Sciences and other at Instituto de Biodiversidad, Santo Domingo de Heredia, Costa Rica.

DIAGNOSIS. — This is one of several Central American species of *Ceraeochrysa* with four dark spots on the pronotum. However, unlike *C. nigripedis, C. inbio*, and *C. elegans*, there are no dark markings on the meso- and metanota. The two species with only two dark spots (*C. discolor* has red spots and a recurved ventral extension of the dorsal apodeme) on the pronotum (*C. tauberae* and *C. costaricensis*) also have completely pale meso- and metanota, but *C. tauberae* has distinctly dark swellings on the forewing at the apex of Cu and 2A. *Ceraeochrysa costaricensis* may be the most closely-related species in that the male gonapsis has lateral arms, the dorsal apodeme of the ectoproct has a ventral extension with apical point, the mediuncus has a pair of large caudolateral lobes and there is an extensive field of gonocristae on the gonosaccus. However, the differences are also numerous: *C. defreitasi* has four pronotal spots rather than two; the male gonapsis has only a single lateral arm; the gonarcus has no mediodorsal plate; the mediuncus lobes are apically pointed, not truncate; and the pair of dorsal lobes of the arcessus are better developed.

HEAD. — Frons, gena, clypeus, labrum, palpi and vertex yellow without dark markings. Antennal scape, pedicel and flagellum yellow without dark markings.

THORAX. — Pronotum yellow with pair of dark reddish brown spots laterally on each side. Meso- and metanota yellow without dark markings. **Wings**: Forewing length = 14.5 mm. Forewing pale green without dark spots on membrane. Longitudinal veins pale green. Costal and radial crossveins dark. Six to eight (six to seven in holotype) inner and eight to nine outer gradate crossveins dark with dark margining of membrane. Inner gradate series sigmoidally curved while outer gradates straight. Hind wing pale green without dark markings. Six inner and eight outer gradate crossveins.

ABDOMEN. — Pale yellow with a pair of small reddish spots posterolaterally on tergites three to six. Male tergite 9 with small pointed dorsal lobe. Dorsal apodeme of ectoproct thick, with elongate ventral projection with acute apical point below ventral margin of ectoproct. Gonapsis elongate with subapical lateral lobe on left side and apical small dorsal point and more elongate ventral point. Gonarcus with ovate lateral arms and no medial points or dorsal plate. Mediuncus with pair of small dorsal points and more elongate pair of caudolateral lobes. Arcessus with pair of lateral acute points and decurved terminal ventromedial point. Gonosaccus with extensive field of small gonocristae in aligned rows and scattered lateral gonosetae.

Etymology. — This species is named for Sergio de Freitas, a chrysopid systematist and ecologist who has done much to elucidate the fauna and biology of Brazilian agro-ecosystems.

Ceraeochrysa discolor (Navás, 1914)

(Figs. 196–201)

Diagnosis. — This is a member of the *cincta* group, a group defined by a recurved branch of the dorsal apodeme of the male ectoproct. It is the only member of this group with a single spot laterally on each side of the pronotum. The only other member of this group with pronotal spots is *C. inbio*, which has two dark spots on each side at the anterior and posterior margins. In addition to the pronotal spots, there are at least two spots on the mesonotum. A double dorsal stripe on the antennal scape and a swollen 2a-3a crossvein also help to distinguish this species from all others. One of the scape stripes is smaller than the other and the mesonotum spots may sometimes be faint. There are also small dark spots under the dorsolateral margin of the pronotum and at the dorsolateral margin of the mesonotum of some specimens.

Geographical Distribution. — This species was originally described from Volcan de Chiriqui in Panama, within sight of the Costa Rican border. Within Costa Rica this species has been collected at: ALAJUELA, Guanacaste National Park, San Ramon Field Station; GUANACASTE, Pitilla Field Station, 9 km S Santa Cecilia; Cacao Field Station, SW of Cacao Volcano; PUNTARENAS, Monteverde Biological Reserve, San Luis; La Amistad National Park, Las Alturas Field Station; and Las Cruces, 6 km S San Vito.

Altitudinal Distribution. — The Panamian record is from 760–1220 m. In Costa Rica from 620 to 1500 m.

Adult Flight Period. — February, March, April, August, November, and December.

Habitat Preference. — Label data indicate that this species is associated with forests, but this genus is rarely collected in deep forest. It is probably a forest-edge dweller.

Ceraeochrysa elegans Penny, 1998

(Figs. 202–207)

Diagnosis. — This is a very distinctive species. There are four dark red spots at the corners of the pronotum, as well as a pair of red spots each on the meso- and metascuta. The abdomen has red bands across the posterior margin of each segment. The apex of the posterior branch of Cu is swollen, darkened and margined with dark on the membrane. In most of these respects it is similar to *C. nigripedis*. However, *C. elegans* has a dark scape stripe and red bands on the abdomen, which are lacking in *C. nigripedis.*

Geographical Distribution. — This species has been collected in northern Mexico and Costa Rica. It can be assumed that it will be found in some intermediate areas as well. Within Costa Rica, *Ceraeochrysa elegans* has been collected at: CARTAGO, Monumento Nacional Guayabo, A. C. Amistad, G. Fonseca, 1 female (allotype) (INBIO); PUNTARENAS: Monteverde Biological Reserve, La Casona Station, E. Bello, 1 male (holotype) (INBIO); and Finca Las Cruces, 6 km S San Vito de Java, J. E. Eger (TAMU).

Altitudinal Distribution. — 1100–1520 m.

Adult Flight Period. — July, September, and December.

Habitat Preference. — All three known localities for this species in Costa Rica have good stands of primary forest, and at Monteverde this is almost the exclusive habitat. However, as this genus is not normally found deep within the forest, it probably dwells at the forest-edge.

Ceraeochrysa everes (Banks, 1920)

(Figs. 208–214)

DIAGNOSIS. — This is a species with dark antennae and narrow, red pronotal stripes. The labial palps are pale and there is a dark brown genal stripe, which will separate this species from *C. claveri*. In the forewing only the costal, radial, and gradate crossveins are darkened. The male genitalia include a large medial hood on the gonarcus and large, dorsally-diverging entoprocesses.

GEOGRAPHICAL DISTRIBUTION. — The type is from French Guiana. It has been recorded under various names from Cuba, Honduras, Panama, Colombia, Trinidad and Brazil. Within Costa Rica this species has been recorded from: ALAJUELA, 20 km S Upala; CARTAGO, Turrialba (C.A.T.I.E.); GUANACASTE, Guanacaste National Park; Maritza Field Station, near Orosí Volcano; 14 km S Cañas; Finca La Pacifica, near Cañas; Río Gongora, 4 km NE Quebrada Grande; and LIMÓN, Pandora.

ALTITUDINAL DISTRIBUTION. — The Pandora locality is at about 100 m elevation, while the Santa Rosa locality is at 300 m.

ADULT FLIGHT PERIOD. — February, June, and September.

HABITAT PREFERENCE. — The Pandora specimen was collected on understory vegetation near a stream in primary forest. The La Pacifica adults were collected in a very similar situation, amongst bushes along a river.

Ceraeochrysa gradata (Navás, 1913)

(Figs. 215–220)

DIAGNOSIS. — This species has pale frons, palpi and genae. The antennal scape bears a dorsal dark stripe and faint indication of lateral stripe. The antennal flagellum is dark basally and pale apically. The pronotum has a narrow, lateral red stripe. Superficially this species appears similar to *C. claveri*, but this latter species has antennae darkened to the apex and a broader pronotal stripe.

GEOGRAPHICAL DISTRIBUTION. — Originally described from Guatemala. Within Costa Rica, it has been collected at LIMÓN, Cahuita National Park: and PUNTARENAS, Monteverde.

ALTITUDINAL DISTRIBUTION. — Sea level to 1400 m.

ADULT FLIGHT PERIOD. — September.

HABITAT PREFERENCE. — Two females were collected amongst woody vegetation directly behind the beach in very humid, swampy conditions, exposed to prevailing winds and sea spray.

REMARKS. — *Ceraeochrysa indicata* (Navás, 1914) and *Ceraeochrysa infausta* (Banks, 1946), both recorded from Costa Rica, are **new synonyms** of *Ceraeochrysa gradata* (Navás, 1913).

Ceraeochrysa inbio Penny, 1997

(Figs. 221–226)

DIAGNOSIS. — This species is distinctive in having four dark spots on the pronotum and pair of dark spots on the mesonotum. It lacks a pair of spots on the metascutum, which are present in *C. elegans* and *C. nigripedis*. It also lacks the swollen apical veins of the posterior cubitus in the forewing, which are present in the latter two species. The long ventral hook of the dorsal apodeme of the male ectoproct indicate a close relationship with other members of the *cincta* group.

GEOGRAPHICAL DISTRIBUTION. — At present this species is known only from the type specimen from Costa Rica: CARTAGO: La Amistad Biosphere Reserve, Guayabo National Monument.

ALTITUDINAL DISTRIBUTION. — 1100 m.

ADULT FLIGHT PERIOD. — July.

HABITAT PREFERENCE. — Unknown.

Ceraeochrysa josephina (Navás, 1926)

This species was originally described from Costa Rica. The original description contains no information that would allow identication of this species and the primary type cannot be located. Adams (1982) synonymized *Chrysopa angulata* Navás, 1929 with *Ceraeochrysa josephina* without having seen the type of the latter species. *Ceraeochrysa angulata*, from Colombia, has a distinctive swelling, darkening and tiny crossvein at the fork of the forewing distal cubital cell, not mentioned in Navás' original description of *C. josephina*. No specimens of *Ceraeochrysa angulata* have yet been recorded from Costa Rica. Until such time as the type of *C. josephina* can be located or a neotype designated, I think it best to consider *Ceraeochrysa josephina* as a *nomen dubium*, and *Ceraeochrysa angulata* as a valid species.

Ceraeochrysa nigripedis Penny, 1997
(Figs. 227–232)

Diagnosis. — This species is very distinctive and should be immediately recognizable, even when some markings are faded. There are always two dark spots on the mesoscutum and two more black spots on the metascutum. Less frequently preserved are four red spots at the corners of the pronotum, a lateral stripe on the antennal scape, and transverse yellow and red bands dorsally on each abdominal segment. There is a darkened area of incrassate veins at the apex of CuP in the forewing. Finally, the last tarsal segment of all legs is contrastingly dark brown to black. This is one of the most colorful species of *Ceraeochrysa*.

Geographical Distribution. — So far, this species is known only from Costa Rica, recorded from two specimens: PUNTARENAS, Monteverde Biological Reserve, La Casona Station, N. Obando, 1 male, 1 female (INBIO, CAS).

Altitudinal Distribution. — 1520 m.

Adult Flight Period. — November.

Habitat Preference. — Unknown.

Ceraeochrysa pseudovaricosa Penny, 1998
(Figs. 233–238)

Diagnosis. — The reticulated series of small, darkened cells in the middle of the inner gradate series of the forewing appear very similar to that of *Chrysopodes varicosa*. However, the two species can be distinguished by the lack of transverse bands on the frons of *C. pseudovaricosa*. The presence of an elongate, spoon-shaped gonapsis in the male genitalia indicate its true affinities within *Ceraeochrysa*.

Geographical Distribution. — So far, this species has only been collected at: Costa Rica: PUNTARENAS: Parque Nacional La Amistad (8°57′N, 82°50′W).

Altitudinal Distribution. — 1500–1600 m.

Adult Flight Period. — Mid-February to early March.

Habitat Preference. — The nine known specimens of this species were collected in primary forest by beating the understory vegetation near the edge of La Amistad National Park. This is an area in the rain shadow of the Talamanca Mountains and in February receives very little rainfall. The forest, although evergreen, is very dry during this period.

Ceraeochrysa sanchezi (Navás, 1924)
(Figs. 239–246)

DIAGNOSIS. — This is one of the species of *Ceraeochrysa* with pale palpi and dark antennae. There is no stripe on the antennal scape, but rather, a darkened diffused reddish area on the lateral surface. This lack of scape stripe separates it from *C. claveri* and *C. indicata*. It also has a yellow mesonotum. The most distinctive features are found in the male terminalia: the elongate ventral projection of the ectoprocts encircling the abdominal apex, the double row of vertical gonocristae above the apex of the ninth sternite, the flattened dorsal entoprocesses and the large, sclerotized teeth on the gonosaccus.

GEOGRAPHICAL DISTRIBUTION. — This species was originally described from Cuba. Adams and Penny (1987) reported collections from Mexico, Honduras and Brazil. Within Costa Rica, it has been collected from ALAJUELA, 20 km S Upala; GUANACASTE, 8 km (5 mi) NE Cañas; Finca La Pacifica, near Cañas; Finca Taboga, near Cañas;14 km S Cañas; Guanacaste National Park; and PUNTARENAS, Las Cruces, 6 km S San Vito.

ALTITUDINAL DISTRIBUTION. — Lowland areas around 300 m or less.

ADULT FLIGHT PERIOD. — December to March.

HABITAT PREFERENCE. — At La Pacifica adults were collected by beating bushes along a river bank in February.

***Ceraeochrysa smithi* (Navás, 1914)**
(Figs. 247–252)

DIAGNOSIS. — This is a striking species with black base to the antennal flagellum and broad, red, lateral pronotal stripes. However, most distinctive are the red dorsal surface of the antennal scape and broadly-triangular, red mark on the vertex at the base of each scape. The male also has a subapical dorsal projection on both sides of the ninth sternite.

GEOGRAPHICAL DISTRIBUTION. — This species is probably found throughout the Caribbean, Central America, and northern South America. It was originally described from the Windward Islands of the West Indies. When Adams (1982a) included the species in *Ceraeochrysa* he synonymized two names under it: *C. neotropica Nav*ás, reported from Colombia and Brazil (Penny 1978) and *C. poeyi* Navás from Cuba. Penny and colleagues (1997) reported *C. smithi* from U.S.A. (Florida). Additional specimens have been reported from Mexico (as far north as Baja California Sur), Guatemala, Honduras, Costa Rica, and Panama. Within Costa Rica specimens are known from: CARTAGO, Turrialba; GUANACASTE, Guanacaste National Park, Agua Buena, Cacao Field Station on the southwest side of Cacao Volcano; Finca Jenny, 31 km N Liberia; Finca La Pacifica, near Cañas; and Río Gongora, 6 km northeast of Quebrada Grande de Liberia; and HEREDIA, Puerto Viejo.

ALTITUDINAL DISTRIBUTION. — From 220 m at Agua Buena to 1000–1400 m at the Cacao Field Station.

ADULT FLIGHT PERIOD. — February, August, September, and November-December.

HABITAT PREFERENCE. — Adults have been collected in bushes near Rio Corobicí at La Pacifica in February.

***Ceraeochrysa tauberae* Penny, 1997**
(Figs. 253–258)

DIAGNOSIS. — *Ceraeochrysa tauberae* is one of the Central American species with two dark spots on the pronotum. This species has darkened, incrassate veins at the apex of CuP in the forewing and forms an interesting convergence with *C. nigripedis*, which has two black spots on the metascutellum. However, *C. tauberae* has a pale metascutellum and a darkened, incrassate a2-a3 crossvein, which at rest is folded over the metascutellum. The inner and outer gradate veins are heavily margined with darkened membrane.

GEOGRAPHICAL DISTRIBUTION. — This species has only been collected in Costa Rica: CARTAGO, near Eslabon; and PUNTARENAS, Finca Las Cruces, 6 km S San Vito.

ALTITUDINAL DISTRIBUTION. — The Las Cruces locality is between 1000–1400 m elevation.

ADULT FLIGHT PERIOD. — Late September to early October and December.

HABITAT PREFERENCE. — The Finca Las Cruces locality is the Wilson Botanical Garden and associated undisturbed forest.

Ceraeochrysa valida (Banks, 1895)

(Figs. 259–264)

DIAGNOSIS. — In live material the frons is pale yellow to white, whereas other species have a pale frons only in faded, preserved material. The dark tips of labial palpi are unusual for this genus. Antennae are pale, with a very broad, dorsal, red scape stripe. The lateral red pronotal stripe is very broad and short There are also only one to three inner gradate veins in the forewing. The male ectoprocts are ventrally extended at their apices.

GEOGRAPHICAL DISTRIBUTION. — This species is broadly distributed from the southeastern U.S.A. south to Ecuador and Brazil. Within Costa Rica it has been found at: GUANACASTE, 14 km S Cañas; Finca La Pacifica, near Cañas; Finca Taboga, near Cañas; and SAN JOSÉ, Escazú.

ALTITUDINAL DISTRIBUTION. — Lowland areas at about 300 m near Cañas, to about 1000 m in the central valley near San José.

ADULT FLIGHT PERIOD. — January to March, May, September, October, and December, but most common from January to March..

HABITAT PREFERENCE. — At Cañas adults have been collected by beating bushes near the Rio Corobicí in February.

Chrysoperla Steinmann, 1964

This genus is probably the most common group of green lacewings worldwide, partly because of its preference for open agricultural and pasture lands, where adults feed on grass pollen. Several species in this genus have been mass reared for release in fields and orchards as augmentative biological control agents. They are among our most important beneficial insects (Tauber et al. 2000) and have great potential for control of white flies, aphids, scale insects and mealybugs in Costa Rica. Eggs are laid singly near concentrations of honeydew excreted by homopterous insects. However, larvae feed on a wide variety of insects which they glean from foliage as they search the plants. Larvae do not cover their bodies with debris or the bodies of their prey. Adults can often be found in large numbers in pastures, lawns, and other areas where grasses are plentiful. All New World species are pale green with a red spot on the gena below the eyes. There is a medial yellow stripe along the mid-dorsal line of the thorax and abdomen. Some species in temperate climates overwinter as hibernating adults and body coloration changes to reflect a changed physiology. As colder weather approaches, body coloration becomes pale brown and a pair of red spots appear on each segment of the abdomen. Adults migrate in very large numbers to the forest, where they rest under live leaves in milder climates and amongst dead, fallen leaves in harsher, colder climates. The genus is worldwide, with 50 known species. Only two species are known from Costa Rica.

KEY TO COSTA RICAN *CHRYSOPERLA*

1. Vertex with a pair of red submedial spots, often fused medially . . . . *C. exotera*
1′. Vertex entirely pale green to pale yellow . . . . *C. externa*

Chrysoperla exotera (Navás, 1913)
(Figs. 265–267)

DIAGNOSIS. — This species is most easily recognized by the large reddish submedial to medial marks in the center of the vertex. The male genitalia are also diagnostic, i.e., male tignum evenly tapered and strongly arched.

GEOGRAPHICAL DISTRIBUTION. — This species is known from Mexico, Guatemala, Honduras, and Costa Rica. Within Costa Rica it has been collected at: GUANACASTE: Finca La Pacifica; and SAN JOSÉ, Escazú.

ALTITUDINAL DISTRIBUTION. — Pacific lowland areas below 200 m to mid-elevations around 1000 m.

ADULT FLIGHT PERIOD. — February to June.

HABITAT PREFERENCE. — Like other members of the genus, this species prefers open, grassy areas, such as the suburban, residential area of Escazú and near disturbed habitats along the Rio Corobicí at Finca La Pacifica.

Chrysoperla externa (Hagen, 1861)
(Figs. 268–270)

DIAGNOSIS. — Characteristics include a pale green vertex with no red markings and a male tignum that is swollen at mid-length and has very little arch to it.

GEOGRAPHICAL DISTRIBUTION. — This is the most widespread species of *Chrysoperla* in the New World, ranging from U.S.A. (Florida) south to Argentina, and can probably be found in all countries in between. It has also been collected on Cocos Island (Costa Rica) and Easter Island. Wherever it occurs, it is also among the most abundant species present, and is the Neotropical ecological counterpart of *C. plorabunda* and *C. rufilabris* in North America and *C. carnea* in Europe. Within Costa Rica it can probably be found anywhere where grasslands exist below 2200 m. Records include: ALAJUELA, 20 km south of Upala; GUANACASTE, Santa Rosa National Park, Quebrada Pedregal; 14 km south of Cañas; 6 miles north of Cañas, Finca La Pacifica, near Cañas; LIMÓN, Hitoy-Cerere Biological Reserve; PUNTARENAS, La Amistad National Park, Las Alturas; La Amistad National Park, upper Río Bellavista; Osa Peninsula, Rincon; and SAN JOSÉ, Escazú.

ALTITUDINAL DISTRIBUTION. — The highest elevation known is 2200 m. Below this level, adults can be found almost anywhere where grasslands exist.

ADULT FLIGHT PERIOD. — Records indicate January through April, although adults probably occur throughout the year.

HABITAT PREFERENCE. — Adults feed on grass pollen and are frequently very abundant in grasslands. They are also taken in orchards and on cultivated crops in Nicaragua. They are attracted to lights in appropriate areas.

Chrysopodes Navás, 1913

Chrysopodes is a Neotropical genus with 32 recognized species (Brooks and Barnard 1990). The genus is most easily defined by the male genital components. The tignum is absent, the gonapsis usually absent, with the gonarcus complex often medially inflated and bulbous. *Chrysopodes* is usually divided into two subgenera with distinctly different appearances. The subgenus *Neosuarius* has narrower forewings, particularly in the costal area. The mandibles are stout, blunt-tipped and asymmetrical. The basic body coloration is often dark, particularly in southern South American species. The subgenus *Chrysopodes* has broader wings with an expanded costal area. They appear to be fragile fliers with very long setae on veins of the forewing. Mandibles are narrow, sickle-shaped and symmetrical. The basic body coloration is always pale green, changing to straw yellow or pale brown after death. Despite the general differences between the subgenera, some species of *Neosuarius* have pale green coloration, and the basic structures of male and female genitalia are quite similar. The two groups are clearly closely related and were grouped into a single genus long before recognition of its subgenera. Several of the Costa Rican species in this genus have very irregular or swollen venation in the middle of the forewing with corresponding dark coloration, creating a focal point of visual attention. Both subgenera appear to reach maximum species richness in South America. Eight species of *Chrysopodes* are currently known from Costa Rica and more are expected to be found.

KEY TO COSTA RICAN *CHRYSOPODES*

1. Forewing with a small, dark, reticulate network of veinlets at middle of inner gradate series . . . . . *C.* (*C.*) *varicosa*
1′. Forewing with gradate series forming a stepwise series, with an occasional auxillary crossvein, but without a small reticulate network of veinlets 2

2(1). Forewing intramedian vein reaching terminal crossvein, forming a quadrate cell 3
2′. Forewing intramedian vein not reaching terminal crossvein, forming an ovate intramedian cell 4

3(2). Antennal scape with a dorsal stripe; frons with a dark transverse band; vertex with a V-shaped dark mark posterior to antennal bases . . . . . *C.* (*N.*) *oswaldi*
3′. Antennal scape entirely pale; frons dark laterally, pale medially; vertex pale except for a small dark mark at caudolateral margin . . . . . *C.* (*C.*) *nevermanni*

4(2) Forewing with a darkened spot at fourth anal crossvein along hind margin; forewing inner gradate series heavily margined with darkened membrane . . . . . *C.* (*C.*) *costalis*
4′. Forewing without dark spots along hind margin; forewing inner gradate series not margined, membrane entirely transparent 5

5(4). Pronotum with four discrete dark red spots; male forewing Rs swollen . . . . . *C.* (*N.*) *crassinervis*
5′. Pronotum either pale, or with red markings at anterior margin, or with longitudinal red stripes, but not four discrete red spots; male forewing Rs swollen or not 6

6(5). Frons entirely pale; maxillary palpi dark only at apex; pronotum with longitudinal red stripe; male forewing Rs not swollen . . . . . *C.* (*C.*) *victoriae*
6′. Frons with two transverse red bands below antennal bases; maxillary palpi dark basally or entirely pale; pronotum pale or with dark red markings only at anterior margin; male forewing Rs at least somewhat swollen 7

7(6). Heavy-bodied, with pronotum pale, wider than long; maxillary palpi entirely pale; gradate crossveins green, unmargined . . . . . *C.* (*N.*) *collaris*
7′. More slender-bodied, with pronotum longer than wide, with dark red spots at anterior margin; maxillary palpi dark, except pale at apex; gradate crossveins dark with dark margining . . . . . *C.* (*N.*) *crassipennis*

***Chrysopodes* (*Chrysopodes*) Navás, 1913**

The characters given above in the generic treatement will serve to distinguish this subgenus. The most recent revision of Chrysopidae (Brooks and Barnard 1990) included 21 species in this subgenus. They are distributed from Guatemala south to Argentina, with greatest species richness apparently occurring in the Amazon Region and other parts of northern South America. Four species are known from Costa Rica.

Chrysopodes (*Chrysopodes*) *costalis* (Schneider, 1851)
(Figs. 292–294)

DIAGNOSIS. — This species has the broad forewing costal area typical of most *Chrysopodes* (*Chrysopodes*), but can be distinguished from other species by the heavier dark markings of the wing. The inner gradate series is heavily infuscated, and the distal part of the anal margin has apical vein twiggings darkened, resulting in the appearance of a stripe along this margin. However, the most distinguishing feature of the forewing is a single crossvein on the hind margin about halfway to the apex that is dark, swollen, and heavily infuscated in the adjacent membrane. The Amazonian species *Chrysopodes* (*C.*) *duckei* and *C.* (*C.*) *pulchella* also have the distinctive small dark area along the anal margin, but the spot is much smaller in these species and they have heavy dark margining of the base of the Rs forks, which is lacking in *C. costalis.*

GEOGRAPHICAL DISTRIBUTION. — The original description only indicates "America" as the locality. No additional published distributional records are known. Within Costa Rica, this species has been collected at: LIMÓN: Pandora, Valle de Estrella.

ALTITUDINAL DISTRIBUTION. — The Pandora locality is at the base of a small hill at the edge of "Star Valley" at less than 200 m elevation.

ADULT FLIGHT PERIOD. — September.

HABITAT PREFERENCE. — The single known Costa Rican individual was collected resting beneath the leaves of young trees, along a small stream. The area was heavily shaded by primary overstory forest and very humid from its proximity to the stream.

Chrysopodes (*Chrysopodes*) *nevermanni* Navás, 1928
(Figs. 295–297)

DIAGNOSIS. — This species is most easily distinguished by its quadrate intramedian cell. This and related species with quadrate intramedian cells also have dark palpi and a dark base to the branches of the forewing radial sector, except *C. costalis*. The two Brazilian species in this group, *C.* (*C.*) *duckei* and *C.* (*C.*) *pulchella* have an irregular third gradate series and a dark spot at one crossvein about halfway to the apex along the hind margin. The other member of this group, *C.* (*C.*) *inornata* from Colombia, lacks this forewing spot, but has lateral red stripes on the pronotum, which are lacking in *C.* (*C.*) *nevermanni.*

GEOGRAPHICAL DISTRIBUTION. — This species was originally descibed from the plains between Limón and La Mercedes on the Caribbean side of the Talamanca Mountains. Other records are from Pandora and Hitoy-Cerere Biological Reserve in Valle de Estrella of LIMÓN Province. So far this species is known only from the coastal plain of southeastern Limón Province.

ALTITUDINAL DISTRIBUTION. — From the margin of the "Star Valley" at under 200 m elevation and near Limón at 150–300 m.

ADULT FLIGHT PERIOD. — March and September.

HABITAT PREFERENCE. — Two individuals were collected resting beneath the leaves of young trees, along a small stream. The area was heavily shaded by primary overstory forest and very humid from its proximity to the stream.

Chrysopodes (*Chrysopodes*) *varicosa* Navás, 1914
(Figs. 298–303)

DIAGNOSIS. — This species is very distinctive because of the small cluster of veinlets in the middle of the inner gradate series of the forewing, which is accentuated by the darkening of the membrane surrounding these veinlets. The only other species with this distinctive feature is *Ceraeochrysa* *pseudovaricosa* which, in addition to its *Ceraeochrysa*-type male genitalia with an elongate gonapsis, also has a lateral stripe on the antennal scape, darker brown markings on the frons, and no transverse red stripes below the antennal bases on the frons.

GEOGRAPHICAL DISTRIBUTION. — This species is known from Guatemala (type specimen) and Costa Rica. In Costa Rica, it is known from: ALAJUELA: 20 km S Upala; Quebrada Virgencita, 10.2 km S Bajos del Toro (10.168°N, 84.326°W); and PUNTARENAS: Monteverde Biological Reserve; Las Alturas; Fila Cedro.

ALTITUDINAL DISTRIBUTION. — This species appears to prefer mid-elevations from 1500–2000 m, although the site at Upala must be lower than this. The Guatemalan type is from 400 m elevation.

ADULT FLIGHT PERIOD. — February, July, and September.

HABITAT PREFERENCE. — Known collecting sites are in tall primary forest.

Chrysopodes (*Chrysopodes*) *victoriae* Penny, 1998
(Figs. 304–309)

DIAGNOSIS. — This is the only species of *Chrysopodes* yet known from Costa Rica with dark antennae (at least basally). The red pronotal stripes coupled with lack of markings on the frons is also distinctive, as is the trilobate apex to male ninth sternite.

GEOGRAPHICAL DISTRIBUTION. — This species is known only from the holotype male collected at: LIMÓN: Pandora, Valle de Estrella.

ALTITUDINAL DISTRIBUTION. — Less than 200 m.

ADULT FLIGHT PERIOD. — September.

HABITAT PREFERENCE. — The holotype was collected resting beneath the leaves of young trees, along a small stream. The area was heavily shaded by primary overstory forest and very humid from its proximity to the stream.

Chrysopodes (*Neosuarius*) Adams and Penny, 1987

The characters mentioned in the generic key and discussion above will delimit this subgenus. Brooks and Barnard (1990) listed 11 species, which range from southeastern U.S.A. and Mexico south to Chile and Argentina. One species, *Chrysopodes* (*Neosuarius*) *nigripilosa* is found only on the Galapagos Islands. Five species are known only from Chile and austral South America, and this area appears to be the most species rich. Two species have broad distributions. *Chrysopodes* (*Neosuarius*) *divisa* is known from Jamaica and Cuba south to Argentina, while *C.* (*N.*) *collaris* is known from southeastern U.S.A. and Mexico (Baja California) south to Guyana and Venezuela. All other species appear to have much more restricted distributions. The four described species from Costa Rica are treated below. There is, in addition, one undescribed, apparently new, species from Costa Rica characterized by heavy infuscation of the membrane surrounding crossveins, which is reminiscent of *C.* (*N.*) *limbata* and *C.* (*N.*) *parishi*, but has a dark lateral scape stripe. Five females of this form have been studied, however, until a male is found, this species shall remain unnamed.

Chrysopodes (*Neosuarius*) *collaris* (Schneider, 1851)
(Figs. 271–276)

DIAGNOSIS. — This is one of the more distinctive species of green lacewings. It is a rather thick-bodied species with pronotum broader than long. It superficially resembles species of *Nacarina* in the Belonopterygini, although the antennae are thinner. There is a distinct complete double transverse red line below the antennae on the frons, which at times becomes a pink suffusion. In the male genitalia the ectoproctal apodeme forks at the callus cercus and the ventral fork extends ventrocaudally as an incurved apical projection. The male arcessus has a thick internal brace, which is lacking in the related *C.* (*N.*) *divisa.*

GEOGRAPHICAL DISTRIBUTION. — This is a wide-ranging species known from the U.S.A. (Florida and Texas), and Mexico (Baja California) south through Central America and the Antilles to Colombia, Venezuela, and Guyana. Within Costa Rica specimens have been recorded from: ALAJUELA, 20 km S Upala; CARTAGO, Playa del Coco; GUANACASTE, Santa Rosa National Park, Río Poza Salada; Quebrada Guacimo; Quebrada Pedregal; 14 km S Cañas; Finca La Pacifica, near Cañas; and PUNTARENAS, Boca de Barranca.

ALTITUDINAL DISTRIBUTION. — 10–300 m.

ADULT FLIGHT PERIOD. — February, May, June, July, and September.

HABITAT PREFERENCE. — At Finca La Pacifica this species was collected at lights near the Rio Corobicí.

Chrysopodes (*Neosuarius*) *crassinervis* Penny, 1998
(Figs. 277–282)

DIAGNOSIS. — This species is immediately recognizable from its two pair of dark spots on the pronotum and the heavily swollen forewing veins in the male. No other species of *Chrysopodes* from Costa Rica is known to have four pronotal spots, although this feature is fairly common among species of *Ceraeochrysa* and *Plesiochrysa*. Another Costa Rican species of *Chrysopodes*, in which males have swollen forewing veins, is *C. crassipennis,* but this species lacks the four pronotal spots.

GEOGRAPHICAL DISTRIBUTION. — So far, this species has only been collected in Costa Rica. Known localities are: GUANACASTE: Río Orosi (10.991°N, 85.928°W); LIMÓN: Parque Nacional Tortuguero, Río Tortuguero, 3.5 km S Tortuguero (10.509°N, 83.504°W); and PUNTARENAS: Finca Las Cruces, 6 km S San Vito de Java; Río Jaba at rock quarry, 1.4 km W Las Cruces (8.79°N, 82.97°W), 16 km (10 mi) S of Rincon de Osa.

ALTITUDINAL DISTRIBUTION. — Sea level to 1280 m.

ADULT FLIGHT PERIOD. — February, March, April, August, and September.

HABITAT PREFERENCE. — At Las Cruces this species was collected at an ultraviolet light. The area contains both a botanical garden and primary forest.

Chrysopodes (*Neosuarius*) *crassipennis* Penny, 2000
(Figs. 283–285)

DIAGNOSIS. — The two most distinctive characteristics of this species are the darkly margined gradate crossveins and swollen (incrassate), forewing, radial sector veins of males.

GEOGRAPHICAL DISTRIBUTION. — This species appears to be rather common in a very restricted area, all within Costa Rica. Although a single female has been collected 14 km S Cañas (GUANACASTE) where a considerable amount of collecting has been done, all other known specimens (more than 100) are from GUANACASTE, 3 km SE Río Naranjo.

ALTITUDINAL DISTRIBUTION. — The two known localities both lie below 200 m.

ADULT FLIGHT PERIOD. — Virtually every month of the year.

HABITAT PREFERENCE. — Unknown.

Chrysopodes (*Neosuarius*) *oswaldi* Penny, new species

(Figs. 286–291)

HOLOTYPE. — Male from "10 mi. S. Rincon de Osa / Puntarenas Proince, Costa / Rica, 4–12.III.69 / J. K. Sheldon Field #/." The holotype is deposited in the Entomology Collection of the California Academy of Sciences, San Francisco. Damage: Right foreleg and hindleg missing. Abdomen detached and placed in genital vial below specimen. Left forewing and hind wing detached and placed on card below specimen.

HEAD. — Frons pale yellow with dark red transverse band below antennal bases; not extended to lateral margin. Gena dark red. Clypeus pale yellow medially, dark red laterally. Labrum pale yellow. Maxillary palp segments dark basally, pale apically. Labial palps pale. Vertex pale yellow with dark red V-shaped mark posterior to antennal bases and small dark spot medially at posterior margin. Antennal scape pale yellow with dorsal longitudinal dark red stripe. Pedicel and flagellum pale yellow.

THORAX. — Pro-, meso- and metanota pale yellow, without markings. Pleural areas and legs pale yellow without markings. **Wings:** Forewing length = 15.5 mm. Forewing pale yellow without dark markings on membrane. Longitudinal veins pale, crossveins dark. Five to six inner and nine outer dark gradate crossveins. Hind wing entirely pale; apex acutely pointed. Five inner and seven to eight outer pale gradate crossveins.

ABDOMEN. — Pale green without markings. Sternites without microtholi. Male ninth sternite evenly tapered to rounded apex. Dorsal apodeme of ectoproct with two ventral extensions: proximal extension apically truncate; distal extension medially curved to acute point. Tignum and gonapsis absent. Gonarcus dorso-ventrally flattened; lateral arms simple quadrate plates. Arcessus bulbous with apically decurved point.

RELATIONSHIPS. — The double ventral projection of the dorsal apodeme of the ectoproct is found in two other species of *Chrysopodes* (*Neosuarius*): *C. collaris* and *C. divisa*. Several characters clearly separate these species. *Chrysopodes* (*N.*) *collaris* is a much more robust species with pronotum wider than long, and forewing venation entirely green. Both *C. collaris* and *C. divisa* have a double transverse band on the frons (Fig. 272) and both species lack the V-shaped mark posterior to the antennal base and the dorsal scape stripe. The intramedian cell is quadrangular in *C.* (*N.*) *oswaldi*, but this character state is somewhat variable, and since there is but one known specimen, this character must, for now, be used with some caution.

ETYMOLOGY. — This species is named for John D. Oswald, who has done much to advance our knowledge of neuropteran systematics and phylogeny.

Meleoma Fitch, 1855

This genus is closely related to *Chrysopa* but most species have one very distinctive feature—males have simple to elaborate structures between the antennae and on the frons. In different species these may range from a simple protuberance to a deep pit with opposing, setiferous prolongations. The antennal scape is very long and arched in some males or flattened and concave in others. A few species lack these special head structures. Species of *Meleoma* are always rather large and robust. This is a New World genus with a center of extant diversity in the southwestern United States and central Mexico. There are 25 known species distributed from southern Canada south to Colombia and Venezuela. Only two species are known from Costa Rica. Both have distinctive red stripes along the margins of the eyes, on the vertex and along the genae to the mandibular bases. Some forewing crossveins are red, slowly changing to black after death.

KEY TO COSTA RICAN *MELEOMA*

1. Forewings with only seven or eight outer gradate crossveins; male with elongate medial process between antennal bases, with two apical tufts of hairs and lateral depression between antennal bases and eyes; male mediuncus pointed apically . . . . *M. titschaki*

1′. Forewing with ten or more outer gradate crossveins; male with only a tiny, rounded projection between antennal bases, and no depression between antennal bases and eyes; male mediuncus expanded and rounded apically *M. poolei*

Meleoma poolei **Adams, 1969**
(Figs. 310, 313, 315)

DIAGNOSIS. — This species has more gradate veins than *M. titschaki*. This character may be used to separate females. Males have a very poorly-developed medial horn between the antennal bases, and no pits lateral to the antennal bases. The male genitalia has an elongate mediuncus which terminates in a spoon-shaped process.

GEOGRAPHICAL DISTRIBUTION. — This species was described from Rancho Grande in Venezuela, and until now was only known from that locality. Within Costa Rica this species has been collected at: CARTAGO, Embalse El Llano; and SAN JOSÉ, El Salvage, Río Tabarcia, 8 km (road) E Palmichal, 9.847°N, 84.164°W.

ALTITUDINAL DISTRIBUTION. — 1650 m.

ADULT FLIGHT PERIOD. — January and September.

HABITAT PREFERENCE. — The Embalse El Llano locality is primary forest, with only mimimal disturbance, but as specimens were collected with light traps, individuals may have been drawn from neighboring cultivated areas.

Meleoma titschaki **Navás, 1928**
(Figs. 311, 312, 314)

DIAGNOSIS. — This species has fewer gradate veins than *M. poolei*. Males have an elongate projection between the eyes which terminates in two downwardly oriented tufts of hair. There is also a shallow pit lateral to each scape. The male mediuncus has a recurved, acutely pointed apex.

GEOGRAPHICAL DISTRIBUTION. — Originally described from Costa Rica, but neotype designated from southern Mexico. Within Costa Rica this species is known from: ALAJUELA, San Ramon Biological Reserve, Río San Lorenzo; Cerro Campana, 6 km NW Dos Rios; Río Peje, 1 km SE San Vicente; GUANACASTE, SW side of Cacao Vulcano, Cacao Biological Station; PUNTARENAS, Río Cotón, Las Tablas; Monteverde; and SAN JOSÉ, San José (original type); Río Tabarcia, 8 km E Palmichal.

ALTITUDINAL DISTRIBUTION. — 640–1990 m. Most records are from above 1400 m.

ADULT FLIGHT PERIOD. — January to September, with one record from November–December, perhaps late in December.

HABITAT PREFERENCE. — Unknown.

Plesiochrysa **Adams, 1982b**

Plesiochrysa was originally described as a subgenus of *Chrysopa* and indeed they are closely related, with males with much the same genital elements present. However, *Chrysopa* as currently defined does not exist in the Neotropical Region. *Plesiochrysa* now has 22 recognized species from southern Asia, Australia, Oceania and the New World tropics (Brooks and Barnard 1990). Two species are found in Costa Rica, and are recognizable by their robust size and four red spots on the pronotum, similar to North American *Chrysopa quadripunctata*. The male genital structures of the two Costa Rican species are indistinguishable.

KEY TO COSTA RICAN *PLESIOCHRYSA*

1. Pronotum wider than long; forewing with gradate series divergent . . . . *P. brasiliensis*
1′. Pronotum longer than wide; forewing with gradate series parallel . . . . *P. elongata*

***Plesiochrysa brasiliensis* (Schneider, 1851)**
(Figs. 316–318)

DIAGNOSIS. — This species can be quickly separated from *P. elongata* by the distinctly divergent series of gradate crossveins in the forewing. The pronotum is also somewhat wider than in the latter species.

GEOGRAPHICAL DISTRIBUTION. — This is a wide ranging species of chrysopid, collected in Cuba, Mexico, Honduras, Nicaragua, Costa Rica, Panama, Colombia, Trinidad, Guiana, Ecuador and Brazil. Within Costa Rica, records are from: ALAJUELA, Cerro Campana, 6 km NW Dos Rios; GUANACASTE, Santa Rosa National Park (SRNP), Maritza Biological Station, Tempisque; SRNP, Río San Josecito; SRNP, Quebrada Pedregal; Río Gongora, 4 km NE Quebrada Grande; 4 km N Cañas; HEREDIA, Chilamate; Braulio-Carrillo National Park, El Ceibo Biological Station; LIMÓN, Tortuguero National Park, 3.5 km S Tortuguero; PUNTARENAS, near Villa Neily; La Amistad National Park, Las Tablas Protective Zone, Sítio Cotón; Las Cruces, near San Vito; and SAN JOSÉ, Finca La Caja (La Uruca); San José.

ALTITUDINAL DISTRIBUTION. — From sea level at Santa Rosa National Park to 1800 m near Las Cruces.

ADULT FLIGHT PERIOD. — Present throughout the year, with the most numerous collections between April and July.

HABITAT PREFERENCE. — This species is attracted to lights and has been collected along large rivers.

***Plesiochrysa elongata* (Navás, 1913)**
(Figs. 319–321)

DIAGNOSIS. — This species is similar to *P. brasiliensis* except that the gradate series of crossveins in the forewing are parallel and the pronotum is longer than wide.

GEOGRAPHICAL DISTRIBUTION. — It is known from Jamaica, Mexico, Cayman Islands, Honduras, Nicaragua, Costa Rica, Panama, Guadaloupe, Peru, and Brazil. Within Costa Rica records are from: CARTAGO, Turrialba, Santa Teresito de Lajas; GUANACASTE, Santa Rosa National Park (SRNP), Quebrada Guacimo; SRNP, Río San Josecito; Rincon de la Vieja National Park, Río Negro; west side of Orosí Vulcano, Maritza Biological Station; PUNTARENAS, Monteverde; and SAN JOSÉ, San José; 96 km S San José, Hotel La Georgina.

ALTITUDINAL DISTRIBUTION. — 255–3100 m (the latter at Hotel La Georgina).

ADULT FLIGHT PERIOD. — Most months between March and November.

HABITAT PREFERENCE. — This species has been collected at lights in disturbed, cultivated habitats.

REMARKS. — This species was reported from Costa Rica under the name *Chrysopa angusta* (Navás, 1914), now considered a synonym of *Plesiochrysa elongata*.

Ungla Navás, 1914

This genus was originally described for a composite insect consisting of a chrysopid clutching the leg of an ant-lion (see Adams 1975). Despite its composite nature, the name remains available, and Brooks and Barnard (1990) chose the chrysopid part of the composite as the original type of a valid genus. The distinguishing characters of this genus are mostly found in the male terminalia. The male ectoproct is short and not tapered basally. The dorsal apodeme, when present, is vertically oriented through the callus cercus. The mediuncus forms a single elongate point, unlike the shorter, bulbous mediuncus of *Chrysopodes*. Brooks and Barnard (1990) recognized four species from Argentina and Peru. However, this genus is now known from Costa Rica and other undescribed species are known from intervening areas. Only one species is known from Costa Rica.

Ungla pallescens Penny, 1998
(Figs. 322–327)

DIAGNOSIS. — This species can be separated from all others by the generic characters, particularly the short, untapered male ectoproct with vertical dorsal apodeme. It is also the only chrysopid known from Costa Rica which has mottled brown coloration imposed on blue-green tints while alive. The widely dispersed whitish highlights when dead also are characteristic, and hence the name *pallescens*, Latin for pale.

GEOGRAPHICAL DISTRIBUTION. — At this time, this species is only known from: Costa Rica: PUNTARENAS, Monteverde, Pension Quetzal.

ALTITUDINAL DISTRIBUTION. — Collected at about 1500 m.

ADULT FLIGHT PERIOD. — September.

HABITAT PREFERENCE. — All three known specimens were collected at a porch light overlooking a disturbed pasture and plantation habitat. The immediate surroundings contained native trees interspersed with bananas, fruit trees, ornamental shrubs, and a grassy yard in a fairly open environment.

NOTE. — Two additional chrysopids have been recorded from Costa Rica: *Chrysopa bulbosa* (Navás, 1926) and *Chrysopa sarta* Banks, 1914. Neither species description contains enough useful information to allow proper placement of these species and at this time must be considered *incertae sedis*.

FAMILY CONIOPTERYGIDAE

by
Martin Meinander

Coniopterygids, or dustywings, are apparently rather abundant in Costa Rica, but are often overlooked because of their small size. The dustywings are quite distinctive, small creatures, less than 3 mm long. In general appearance the adults bear a considerable resemblance to the white-flies (Homoptera: Aleyrodidae), with a white waxy substance covering the whole insect. Larvae are arboreal, highly predatory, feeding on aphids (Homoptera: Aphidiidae) and scale insects (Homoptera: Coccoidea). Adults are most active at dusk and dawn, when they sometimes can be seen in swarms. Accurate identification of the species in this family generally requires an examination of the male genitalia, while identification to generic level can be done based on wing venation. Identification of females is presently impossible for many species, although in the future female genitalia will certainly yield accurate key characters. The primary difficulty in using female genitalia is weak sclerotization of important structures.

The various species are easily beaten from trees and bushes and are attracted to light.

In addition to the species recorded from Costa Rica, species recorded from Nicaragua and Panama are also included, as many species from the latter countries probably also occur in Costa Rica.

KEY TO THE SUBFAMILIES AND GENERA OF COSTA RICAN CONIOPTERYGIDAE

1. Head capsule in lateral view distinctly higher than broad, genae broad (Fig. 329); two radio-medial crossveins (Figs. 331–332: r-m) in middle of forewing; in hind wing, Rs branching off from R very near base of wing (Figs. 331–332) . . . . Subfamily Aleuropteryginae 2

1′. Head capsule in lateral view fairly spherical, genae narrow (Fig. 330); one radio-medial crossvein in middle of forewing (Figs. 333–334: r-m); in hind wing Rs not branching off from R very near base of wing (Figs. 333–334). . . . . Subfamily Coniopteryginae 3

2(1). Radial crossvein in hind wing (Fig. 331: r-r) striking Rs on stem of fork . . . . *Aleuropteryx*

2′. Radial crossvein in hind wing (Fig. 332: r-r) striking Rs on branch R_{2+3} . . . . *Neoconis*

3(1). M of hind wing unforked (Fig. 333) . . . . *Coniopteryx*

3′. M of hind wing forked into M_{1+2} and M_{3+4} (Fig. 334) . . . . *Semidalis*

SUBFAMILY ALEUROPTERYGINAE

Aleuropteryx Löw, 1885

Scape and pedicel elongate. Male pedicel with a distinct ventral spine. Forewings short, subtriangular, often rather dark in color. In forewing vein CuP generally sinuous (Fig. 331). In hind wing veins M and Cu_1 in their proximal half very close to each other. It is still highly probable that new species are to be found, and identification usually requires investigation of the male genitalia. In addition, sclerotized parts of female genitalia provide good specific characters.

This is a Holarctic genus with 16 species recorded from North and Central America, with a center of distribution in the southwestern U.S.A. and Mexico. Individuals are only very rarely encountered in great numbers.

KEY TO COSTA RICAN MALE *ALEUROPTERYX*

1. Scape about three times as long as broad; pedicel with ventral spine longer than pedicel annulus (Fig. 329) . . . . *A. clavicornis*

1′. Scape about twice as long as broad; spine on pedicel shorter than pedicel annulus . . . . *A. rugosa*

***Aleuropteryx clavicornis* Meinander, 1995**
(Figs. 329, 335–338)

DIAGNOSIS. — The male is readily recognized by the long scape and the very prominent spine of the pedicel. Internal male genitalia: lateral view, Fig. 335; ventral view, Fig. 336; caudal view, Fig. 337; dorsal view, Fig. 338.

GEOGRAPHICAL DISTRIBUTION. — The only known specimen is from Costa Rica: GUANACASTE.

ALTITUDINAL DISTRIBUTION. — Unknown.

ADULT FLIGHT PERIOD. — March.

HABITAT PREFERENCE. — Unknown.

Aleuropteryx rugosa Meinander, 1995
(Figs. 339–342)

DIAGNOSIS. — Spiny roof of ring of ninth sternite (IX) of the male genitalia as well as shape of the process of ninth sternite (pro IX) is diagnostic. Internal male genitalia: lateral view, Fig. 339; ventral view, Fig. 340; caudal view, Fig. 341; dorsal view, Fig. 342.

GEOGRAPHICAL DISTRIBUTION. — This species is known from Nicaragua, and not yet recorded from Costa Rica.

ALTITUDINAL DISTRIBUTION. — Unknown.

ADULT FLIGHT PERIOD. — In Nicaragua collected from February to September.

HABITAT PREFERENCE. — Unknown.

Neoconis Enderlein, 1929

The head capsule has a large unsclerotized area on the frons, which includes the antennal sockets and extends downwards medially in a long tongue to the clypeus. In the forewing, the distal crossveins Sc-R, R_1-R_{2+3} and the crossvein-like basal part of R_{4+5} almost forming a line. The radial crossvein (r-r) of the hind wing strikes the Rs on its branch R_{2+3} well distally of fork of Rs. Identification of species requires investigation of internal male genitalia.

This is an American genus with 16 described species, of which two are recorded from Central America southeast of Mexico.

KEY TO CENTRAL AMERICAN *NEOCONIS*

1. Forewing almost concolorous; ninth segment of male abdomen apically with about five pairs of very broad dentiform spines (Figs. 343, 344) . . . . *N. dentata*

1′. Forewing along margin between the veins with round dark spots and round spot around point where crossveins Rs-M and M-Cu_1 strike M; ninth segment of male abdomen apico-laterally with short, narrow, apophysis which is bent inwards and bears two or three prominent spines (Figs. 349, 350) . . . . *N. marginata*

Neoconis dentata Meinander, 1972
(Figs. 343–348)

DIAGNOSIS. — Ectoprocts (Fig. 343: ect) of male with about five strong bristles. Male genitalia, lateral view, Fig. 343; caudal view, Fig. 344; ventral view, Fig. 345. Paramere, lateral view, Fig. 346. Internal genitalia ventral view, Fig. 347. Wings, Fig. 348.

GEOGRAPHICAL DISTRIBUTION. — Recorded from Costa Rica (Bataan); and Nicaragua.

ALTITUDINAL DISTRIBUTION. — Unknown.

ADULT FLIGHT PERIOD. — Two records, one from April, the other from July.

HABITAT PREFERENCE. — Unknown.

Neoconis marginata Meinander, 1972
(Figs. 349–355)

DIAGNOSIS. — The spotted forewings (Fig. 355) are distinct, but study of the male genitalia is always needed to confirm identification. Male genitalia ventral view, Fig. 349; lateral view, Fig. 350. Penis dorsal view, Fig. 351; lateral view, Fig. 352. Internal male genitalia dorsal view, Fig. 353. Paramere and stylus lateral view, Fig. 354.

GEOGRAPHICAL DISTRIBUTION. — Recorded from southwestern U.S.A., Mexico, and Nicaragua.

ALTITUDINAL DISTRIBUTION. — Unknown.

ADULT FLIGHT PERIOD. — The records from Nicaragua are from February to September; from Texas *N. marginata* is recorded from April to November.

HABITAT PREFERENCE. — Unknown.

SUBFAMILY CONIOPTERYGINAE

Coniopteryx **Curtis, 1834**

By far the largest genus of dustywings, *Coniopteryx* has a worldwide distribution and is represented on all larger land masses. The genus is divided into six subgenera with more than 150 currently recognized species. This genus is recognizable by the unforked media (Fig. 333M) of the hind wing. The wing shape is also distinct, with forewings being broad, about twice as long as broad, fore margin proximally concave, and hind wings with distinctly rounded hind margin. There is a distinct sexual dimorphism in the antennae. The flagellar segments of males are wider than long and have scalelike hairs at the apex, while segments of females are longer than wide and only ordinary hairs are present. The male antennae thus have a much thicker appearance.

KEY TO MALE *CONIOPTERYX*

1. Gonarcus (gc) and hypandrium (hy) synscleritous (Fig. 361). . . . . (*Scotoconiopteryx*) 3
1′. Gonarcus and hypandrium discleritous (Fig. 356) 2

2(1′). Base of stylus (sty) attached to gonarcus (gc) far basally of apex (Fig. 357) . . (*Xeroconiopteryx*) . . *C.* (*X.*) *falcata*
2′. Base of stylus attached to gonarcus near apex (Fig. 398) . . . . . . (*Coniopteryx s. str.*) 8

3(1). The median apical incision of hypandrium (mai) small, less than half the length of hypandrium (Fig. 367) *C.* (*S.*) *flinti*
3′. The median apical incision of hypandrium (mai) at least half as deep as length of hypandrium (Fig. 379) 4

4(3′). Hypandrium in ventral view with very long and narrow processes terminales (pt) (Fig. 379) . . . . *C.* (*S.*) *isthmicola*
4′. Processes terminales of hypandrium (pt) in ventral view short and blunt (Fig. 384) 5

5(4′). Parameres (pa) without long apical downward-directed part (Fig. 381) . . . . *C.* (*S.*) *panamensis*
5′. Parameres apically curved downwards, the downward-directed part being about half as long as the horizontal part (Fig. 362) 6

6(5′). Downwards-directed apical part of paramere strongly curved . . . . *C.* (*S.*) *fumicolor*
6′. Downwards-directed apical part of paramere straight (Fig. 362) 7

7(6′). Median apical incision of hypandrium (mai) about as broad as deep (Fig. 364) . . . . *C.* (*S.*) *cyphodera*
7′. Median apical incision of hypandrium several times as deep as broad (Fig. 374) . . . . *C.* (*S.*) *fumata*

8(2′). No hook on frons; maxillary palpi not broadened . . . . *C.* (*S.*) *freytagorum*
8′. Frons with a distinct hook; fourth segment of maxillary palpi broadened (Fig. 386) 9

9(8′). Hypandrium with an inner, transverse distally bifurcate plate (hyt) proximal to median apical incision (Figs. 387, 388); paramere apically terminating in a fairly long downwards-directed part (Fig. 389) . . . . . . *C.* (*C.*) *californica*
9′. Hypandrium without an inner transverse plate (Fig. 398); paramere apically terminating in dorsal transverse plate (Fig. 398) . . . . *C.* (*C.*) *mexicana*

Coniopteryx **(*Xeroconiopteryx*) Meinander, 1972**

This subgenus has a worldwide distribution and species are often confined to low vegetation in arid areas. The wing membrane is generally pale. In the male genitalia the gonarcus (gc) and hypandrium (hy) are distinctly discleritous and the styli (sty) are attached to the base of the gonarcus. Styli are mostly bifurcate with the anterior branch forming an arch below the parameres. Five species are presently recognized from the Americas, four of which are known from North America.

***Coniopteryx* (*Xeroconiopteryx*) *falcata* Meinander, 1995**
(Figs. 356–360)

DIAGNOSIS. — This is the only American species of *Xeroconiopteryx*, which has scalelike hairs on the apex of the flagellar segments. A secure identification requires study of the internal male genitalia. Male genitalia, lateral view, Fig. 356; caudal view, Fig. 357. Hypandrium, ventral view, Fig. 358. Gonarcus, styli and internal genitalia, ventral view, Fig. 359. Paramere, Fig. 360.
GEOGRAPHICAL DISTRIBUTION. — Described from Nicaragua.
ALTITUDINAL DISTRIBUTION. — Unknown.
ADULT FLIGHT PERIOD. — January and February.
HABITAT PREFERENCE. — Unknown.

***Coniopteryx* (*Scotoconiopteryx*) Meinander, 1972**

An American subgenus with 28 presently recognized species, five of which are recorded from Central America. The species are mostly confined to the canopies of trees. Membrane of wings is generally darkish. In the male genitalia, the gonarcus and hypandrium are proximally syncleritous and the styli, which form a simple semicircular band below the parameres, are attached to the apex of the gonarcus.

***Coniopteryx* (*Scotoconiopteryx*) *cyphodera* Johnson, 1978**
(Figs. 361–365)

DIAGNOSIS. — Penis (p) very thin and straight. Resembles *C. fumata* closely, from which it can be distinguished by the characters mentioned in the key. Male genitalia, lateral view, Fig. 361; caudal view, Fig. 362. Hypandrium, ventral view, Fig. 364. Internal genitalia, lateral view, Fig. 363; ventral view, Fig. 365.
GEOGRAPHICAL DISTRIBUTION. — Nicaragua and Panama.
ALTITUDINAL DISTRIBUTION. — Unknown.
ADULT FLIGHT PERIOD. — February to October.
HABITAT PREFERENCE. — Unknown.

***Coniopteryx* (*Scotoconiopteryx*) *flinti* Meinander, 1975**
(Figs. 366–370)

DIAGNOSIS. — Sclerotized parts of penis in lateral view relatively thick. Close to *C. panamensis*, from which it can be distinguished by the shallow median apical incision of hypandrium (mai) and in ventral view the distinct processes terminales of hypandrium (pt). Male genitalia in lateral view, Fig. 366; caudal view, Fig. 367. Hypandrium in ventral view, Fig. 369. Internal genitalia in lateral view, Fig. 368; ventral view, Fig. 370.
GEOGRAPHICAL DISTRIBUTION. — Mexico, Nicaragua, Colombia, and Brazil.
ALTITUDINAL DISTRIBUTION. — Unknown.
ADULT FLIGHT PERIOD. — May.
HABITAT PREFERENCE. — Unknown.

Coniopteryx (*Scotoconiopteryx*) *fumata* Enderlein, 1907
(Figs. 371–375)

DIAGNOSIS. — Penis very thin and straight. Closely resembles *C. cyphodera*, from which it can be distinguished by the characters mentioned in the key. Male genitalia in lateral view, Fig. 371; in caudal view, 372. Hypandrium, ventral view, Fig. 374. Internal genitalia, lateral view, Fig. 373; ventral view, Fig. 375.

GEOGRAPHICAL DISTRIBUTION. — Costa Rica, Dominican Republic, Colombia and Brazil. Within Costa Rica collected at CARTAGO: Turrialba (C.A.T.I.E.).

ALTITUDINAL DISTRIBUTION. — Turrialba is at mid-elevation (1000–1500 m).

ADULT FLIGHT PERIOD. — From Costa Rica recorded in June.

HABITAT PREFERENCE. — Unknown.

Coniopteryx (*Scotoconiopteryx*) *fumicolor* Meinander, 1972

DIAGNOSIS. — Part of a group of species with parameres apically downward-directed. The paramere apices of *C.* (*S.*) *fumicolor* are stronly recurved. The medial notch of the hypandrium is deeply and narrowly parallel-sided (see Meinander 1972, fig. 148).

GEOGRAPHICAL DISTRIBUTION. — Known only from Costa Rica. Within the country reported from: PUNTARENAS, Palmar; and SAN JOSÉ, Perez Zeledon.

ALTITUDINAL DISTRIBUTION. — Unknown.

ADULT FLIGHT PERIOD. — August.

HABITAT PREFERENCE. — The Palmar specimens are labelled as "rain forest."

Coniopteryx (*Scotoconiopteryx*) *isthmicola* Meinander, 1972
(Figs. 376–380)

DIAGNOSIS. — Readily recognized by the very long processes terminales of the hypandrium (pt). Male genitalia lateral view, Fig. 376; caudal view, Fig. 377. Hypandrium, ventral view, Fig. 379. Paramere, lateral view, Fig. 378. Parameres, styli and penis sclerites, ventral view, Fig. 380.

GEOGRAPHICAL DISTRIBUTION. — Recorded from Mexico, Honduras, Nicaragua, and Panama.

ALTITUDINAL DISTRIBUTION. — Unknown.

ADULT FLIGHT PERIOD. — March to December.

HABITAT PREFERENCE. — Unknown.

Coniopteryx (*Scotoconiopteryx*) *panamensis* Meinander, 1974
(Figs. 381–385)

DIAGNOSIS. — Sclerotized parts of penis in lateral view relatively thick and slightly curved. Close to *C. flinti*, from which it can be distinguished by the very broad, median apical incision of the hypandrium (mai) and the indistinct processes terminales of the hypandrium. Male terminalia, lateral view, Fig. 381; caudal view, Fig. 382. Hypandrium, ventral view, Fig. 384. Internal genitalia, lateral view, Fig. 383; ventral view, Fig. 385.

GEOGRAPHICAL DISTRIBUTION. — Costa Rica, Panama, Colombia, Venezuela, Trinidad and Brazil.

ALTITUDINAL DISTRIBUTION. — Unknown.

ADULT FLIGHT PERIOD. — In Central America recorded in February, March, and May.

HABITAT PREFERENCE. — Unknown.

Coniopteryx (*Coniopteryx*) *sensu strictu* Curtis, 1834

This subgenus has a worldwide distribution with 22 species recorded from America, three of which are from Central America, southeast of Mexico. Wing membrane is generally pale. In the male genitalia the gonarcus and hypandrium are distinctly discleritous and the styli are attached to the apex of the gonarcus (or nearly so). Styli are forked (Fig. 389), the anterior branch of which is attached to the processus ventralis of the parameres. Hypandrium in lateral view about as high as broad. Processes laterales of the hypandrium are prominent, forming the dorso-caudal corner of the hypandrium.

Coniopteryx (*Coniopteryx*) *californica* Meinander, 1974
(Figs. 386–391)

DIAGNOSIS. — This species belongs to a species group recognized by a hook on the frons, above the hook a transverse band of stiff hairs and by a broadened fourth segment of the maxillary palpi (head, Fig. 386). In *C. californica*, there are no apophyses on any segment of the maxillary palpi. The parameres terminate apically in a ventral, long, acute apophysis. Male genitalia, lateral view, Fig. 387; caudal view, Fig. 388. Hypandrium, ventral view, Fig. 390. Internal genitalia, lateral view, Fig. 389; ventral view, Fig. 391.

GEOGRAPHICAL DISTRIBUTION. — U.S.A. (California and Texas) and Nicaragua.

ALTITUDINAL DISTRIBUTION. — Unknown.

ADULT FLIGHT PERIOD. — In Nicaragua collected in September.

HABITAT PREFERENCE. — Unknown.

Coniopteryx (*Coniopteryx*) *freytagorum* Johnson, 1978
(Figs. 392–396)

DIAGNOSIS. — No hook on frons, palpi normal, transverse plate of hypandrium small. An investigation of the male genitalia is necessary for an accurate identification, although this is presently the only species of the subgenus *Coniopteryx* recorded from the isthmus of Central America that lacks a hook on the frons. Male genitalia, lateral view, Fig. 392; caudal view, Fig. 393. Hypandrium, ventral view, Fig. 395. Internal genitalia, lateral view, Fig. 394; ventral view, Fig. 396.

GEOGRAPHICAL DISTRIBUTION. — A common species in Honduras, Nicaragua and Costa Rica. Within Costa Rica collected from GUANACASTE: 3 km SE Naranjo; PUNTARENAS : La Amistad National Park; SAN JOSÉ: Escazú.

ALTITUDINAL DISTRIBUTION. — 1500–2330 m (the latter at La Amistad National Park).

ADULT FLIGHT PERIOD. — Throughout the year.

HABITAT PREFERENCE. — Collected on understory saplings, including many *Peperonia* plants, in mixed montane primary forest with many large *Ficus* trees.

REMARKS. — Earlier reports of *Coniopteryx simplicior* from Costa Rica actually pertain to this species (see Meinander 1995).

Coniopteryx (*Coniopteryx*) *mexicana* Meinander, 1974
(Figs. 397–401)

DIAGNOSIS. — This species belongs to a species group recognized by a hook on the frons; above the hook a transverse band of stiff hairs; and by a broadened fourth segment of the maxillary palpi. In *C. mexicana* there are no apophyses on any segment of the maxillary palpi. Parameres terminate apically in dorsal transverse plates. Male genitalia, lateral view, Fig. 397; caudal view, Fig. 398.

Hypandrium, ventral view, Fig. 400. Paramere, lateral view, Fig. 399. Internal genitalia, ventral view, Fig. 401.

GEOGRAPHICAL DISTRIBUTION. — Mexico, Nicaragua, Costa Rica, and Colombia.

ALTITUDINAL DISTRIBUTION. — Unknown.

ADULT FLIGHT PERIOD. — In Central America this species is recorded from November to May.

HABITAT PREFERENCE. — Unknown.

Semidalis Enderlein, 1905

A genus distributed worldwide with representatives on all larger land masses. Currently about 60 species are recognized, about half of which are American. The species can be distinguished by the internal male genitalia. There is a certain variation in the genitalia and probably some of the presently recognized species will prove conspecific when more material is available and the range of variation better known.

The genus can be distinguished by the forked media (M) in the hind wing and crossvein M-CuA striking the posterior branch of M and obliquely oriented relative to the longitudinal veins. The shape of the wings is distinctive, forewings triangular with almost straight fore margin and hind margin to the tip of CuA. Hind margin of hind wing convex.

KEY TO COSTA RICAN MALE *SEMIDALIS*

1. Paramere (Fig. 403) dorsally with a forward-directed tooth; uncini fused into an H-shaped transverse plate in caudal view (Fig. 404) . . . . *S. arnaudi*
1′. Paramere without a dorsal, forward-directed tooth; uncini not fused to a single plate 2

2(1′). Ectoproct terminates in a spine, which has a lobe or tooth on its inner edge (Figs. 411, 412) 3
2′. Ectoproct blunt and without any appendix on its inner edge (Figs. 418, 422) 4

3(2). Ectoproct caudally terminating in an acute spine (Fig. 430) . . . . *S. soleri*
3′. Ectoproct on its inner edge with an inwards directed blunt lobe (Fig. 424) . . . . *S. rondoniensis*
3″. Ectoproct with a small tooth about medially on its inner margin (Fig. 408) . . . . *S. manausensis*

4(2′). Paramere caudally curved upwards and terminating in a narrow, tapering transverse plate (Fig. 420) . *S. panamensis*
4′. Paramere caudally straight or tip slightly curved downwards (Fig. 415) . . . . *S. mexicana*

Semidalis arnaudi Meinander, 1972
(Figs. 402–406)

DIAGNOSIS. — The forward-directed tooth of the paramere (Fig. 403) is distinct. Parameres, in lateral view, apically swollen, terminally with an upwards directed spine. Uncini (Figs. 404–405) fused into a single transverse plate, which in caudal view has a deep, centro-dorsal incision and a shallower ventral one. Male genitalia, lateral view, Fig. 402. Parameres, lateral view, Fig. 403; ventral view, Fig. 406. Uncini, caudal view, Fig. 404; lateral view, Fig. 405.

GEOGRAPHICAL DISTRIBUTION. — U.S.A. (Arizona), Mexico and Nicaragua.

ALTITUDINAL DISTRIBUTION. — Unknown.

ADULT FLIGHT PERIOD. — The Nicaraguan specimens were collected from September to March.

HABITAT PREFERENCE. — Unknown.

Semidalis manausensis Meinander, 1980
(Figs. 407–413)

DIAGNOSIS. — There are at least three pairs of sclerotized rods below the apex of the parameres, which apically are forked into two or three spines. Male genitalia, lateral view, Fig. 407; caudal view, Fig. 408. Caudal parts of internal genitalia, lateral view, different specimens, Figs. 409, 411–413; ventral view, Fig. 410.

GEOGRAPHICAL DISTRIBUTION. — Mexico south to Brazil (Amazonas) and Peru (Huánaco). This species seems to be common in Costa Rica, where it is recorded from CARTAGO: Embalse El Llano; GUANACASTE: La Taboga Forest Reserve, 9 km SW Cañas; LIMÓN: Hitoy-Cerere Biological Reserve; PUNTARENAS: La Amistad National Park; Fila Cedro; Río Cotón; and SAN JOSÉ: Escazú.

ALTITUDINAL DISTRIBUTION. — In La Amistad National Park, near Las Alturas, this species has been found between 1350 and 2100 m.

ADULT FLIGHT PERIOD. — Recorded in Costa Rica from September to March.

HABITAT PREFERENCE. — Individuals were collected in primary forest by beating the understory vegetation near the edge of La Amistad National Park. This is an area in the rain shadow of the Talamanca Mountains and in February receives very little rainfall. The forest, although evergreen, is very dry during this period.

Semidalis mexicana **Meinander, 1972**
(Figs. 414–419)

DIAGNOSIS. — The ectoprocts are short and blunt. Sclerites below apex of paramere are small. Male genitalia, lateral view, Fig. 414; caudal view, Fig. 415. Internal genitalia, lateral view, different specimens, Figs. 416–419.

GEOGRAPHICAL DISTRIBUTION. — *Semidalis mexicana* has been recorded under different names from Mexico, Nicaragua, Costa Rica, and Colombia. Within Costa Rica, this species is recorded from GUANACASTE and SAN JOSÉ Provinces.

ALTITUDINAL DISTRIBUTION. — Unknown.

ADULT FLIGHT PERIOD. — Within Costa Rica this species is recorded from February to September.

HABITAT PREFERENCE. — Unknown.

Semidalis panamensis Meinander, 1974
(Figs. 420–422)

DIAGNOSIS. — Resembles *S. rondoniensis* from which it can be distinguished by the lack of the lobe on the inner margin of the ectoprocts. Except for a pair of lateral sclerites around the apex of the parameres, the paramere apparently has two backward-directed spines ventrally on the apex. They can also be separate sclerites. Parameres are caudally curved upwards and terminate in longitudinal, upward-tapering transverse plates. *Semidalis brasiliensis* Meinander, 1974 and *S. ecuadoriana* Meinander, 1983 are probably conspecific with this species. Male genitalia, caudal view, Fig. 420; lateral view, Fig. 421. Parameres, lateral view, Fig. 422.

GEOGRAPHICAL DISTRIBUTION. — Costa Rica, Panama, Colombia, Venezuela, Trinidad, and Brazil (Rio de Janeiro). If *S. brasiliensis* and *S. ecuadoriana* prove conspecific, there are records also from Colombia, Ecuador, and Brazil (Santa Catarina). Within Costa Rica this species was collected at PUNTARENAS: Quepos.

ALTITUDINAL DISTRIBUTION. — Quepos is at sea level.

ADULT FLIGHT PERIOD. — The Costa Rican collection was in February.

HABITAT PREFERENCE. — Unknown.

Semidalis rondoniensis **Meinander, 1982**

(Figs. 423–429)

DIAGNOSIS. — Typical for *S. rondoniensis* is the lobe on the inner margin of the ectoproct. There is a considerable variation in the genitalia and in some specimens the lobe is longer and the apex is serrate. Male genitalia, lateral view, Fig. 423; caudal view, Fig. 424. Parameres, lateral view, different specimens, Figs. 425–429.

GEOGRAPHICAL DISTRIBUTION. — Costa Rica, Colombia, Venezuela, Peru, Bolivia and Brazil. Within Costa Rica, *S. rondoniensis* is recorded from LIMÓN: Hitoy-Cerere Biological Reserve.

ALTITUDINAL DISTRIBUTION. — Elevation ca. 200 m.

ADULT FLIGHT PERIOD. — March.

HABITAT PREFERENCE. — Understory of low, moist, open, secondary vegetation along trail.

Semidalis soleri **Monserrat, 1985**

(Figs. 430–433)

DIAGNOSIS. — The male genitalia resemble those of *S. rondoniensis*, but the very acute ectoprocts are distinct. Male genitalia, lateral view, Fig. 430; caudal view, Fig. 431. Internal genitalia, lateral view, Fig. 432. Caudal parts of internal genitalia, ventral view, Fig. 433.

GEOGRAPHICAL DISTRIBUTION. — *Semidalis soleri* was described from Mexico. There is a long series from Costa Rica; PUNTARENAS: La Amistad National Park.

ALTITUDINAL DISTRIBUTION. — Records from near Las Alturas, La Amistad National Park in Puntarenas Province indicate a elevational distribution from 1500 to 2000 m.

ADULT FLIGHT PERIOD. — February to March.

HABITAT PREFERENCE. — Individuals of this species were collected in primary forest by beating the understory vegetation near the edge of La Amistad National Park. This is an area in the rain shadow of the Talamanca Mountains and in February receives very little rainfall. The forest, although evergreen, is very dry during this period.

FAMILY DILARIDAE

by

Norman D. Penny

Dilarids superficially resemble small moths and many go undetected in light trap samples. New World species all belong to the genus *Nallachius*, which has broad dark bands or large spots on the wings. Males have pectinate (feathery) antennae (Fig. 434), whereas females have the more usual filiform antennae. Larvae are predators of wood-dwelling arthropods in rotting logs. Three species have been recognized in the Costa Rican fauna, but because of their small size and forest habitat, few individuals have been collected. They are attracted to light and that is the most frequent means of capture.

KEY TO COSTA RICAN *NALLACHIUS*

1. Forewing MP_2 fused with CuA for some distance; MP_1 appearing simple to near wing apex. (Fig. 436) 2
1′. Forewing MP_2 not fused with CuA; MP_1 appearing deeply forked(to basad of Rs + MA fork) (Fig. 437) *N. pulchellus*

2(1). Dark bands of forewing mostly complete (Fig. 436); dorsal lobes of ectoproct pincer-like . . . . *N. parkeri*

2′. Dark bands of forewing mostly incomplete, giving appearance of nebulous clouds(Fig. 435); dorsal lobes of ectoproct simple, not bifurcate . . . . *N. americanus*

Nallachius americanus (McLachlan, 1880)
(Fig. 435)

DIAGNOSIS. — This species can be separated from *N. pulchellus* by the apparent deeply forked forewing MP_1 in the latter species. The only other Costa Rican dilarid, *N. parkeri* also has a shallowly forked MP_1, and can only be separated with confidence by studying the male genitalia. In general, *N. americanus* appears to be a somewhat paler species with slightly narrower wings. However, there is too much variability to these character states to be consistently useful.

GEOGRAPHICAL DISTRIBUTION. — Eastern U.S.A. south to Venezuela (Adams 1970). Within Costa Rica, *N. americanus* has been collected only with light traps at 3 km SE of Río Naranjo in GUANACASTE Province.

ALTITUDINAL DISTRIBUTION. — Unknown.

ADULT FLIGHT PERIOD. — Late November to late December.

HABITAT PREFERENCE. — Unknown.

Nallachius parkeri Penny, 1994
(Fig. 436)

DIAGNOSIS. — This species closely resembles *N. americanus*, but males can be separated by the deep bifurcation of the dorsal lobe of the ectoproct and lack of a triangular projection on the posterior border of the ninth tergite.

GEOGRAPHICAL DISTRIBUTION. — This species is only known from light traps at 3 km SE of Río Naranjo in GUANACASTE Province.

ALTITUDINAL DISTRIBUTION. — Unknown.

ADULT FLIGHT PERIOD. — This species may have a bimodal emergence period. Three specimens have been collected from late January to early March, while one male was taken in mid-September.

HABITAT PREFERENCE. — Unknown.

Nallachius pulchellus Banks, 1938
(Fig. 437)

DIAGNOSIS. — Currently this is the only species of dilarid known from Costa Rica which does not have MP_2 fused with CuA, giving MP_1 a deeply forked appearance.

GEOGRAPHICAL DISTRIBUTION. — The male type is from Cuba. Other specimens are known from U.S.A. (Arizona) south through Mexico. Costa Rica is as far south as this species has been recorded. Within Costa Rica this is the most widely distributed and most commonly encountered species of *Nallachius*. It is known from GUANACASTE: 3 km SE of Río Naranjo; Santa Rosa National Park; PUNTARENAS: Reserva Carara; and SAN JOSÉ: Escazú.

ALTITUDINAL DISTRIBUTION. — Unknown.

ADULT FLIGHT PERIOD. — Early December to May (Río Naranjo), but a record from farther north at Santa Rosa National Park in July suggests that adults may be present during most of the year.

HABITAT PREFERENCE. — Unknown.

FAMILY HEMEROBIIDAE

by
Victor J. Monserrat

Hemerobiids constitute one of the largest families of Neuroptera, with about 550 known species worldwide, and their geographical distribution includes all continents except Antarctica. This is a relatively abundant family in Costa Rica and is well represented in the fauna. Hemerobiids are medium-sized insects, easily recognized by their filamentous antennae, by wings held roof-like over the abdomen when resting, and by their generally pale brown, frequently cryptic, coloration. Adults are weak fliers with crepuscular and noctural habits, and because of this, habitually spend the day resting on leaves and are frequently attracted to lights at night. They are usually predators of phytophagous insects, and are utilized in biological control of aphids, scale insects, etc., but also occasionally feed on sugary fluids and pollen. Larvae are also very active predators with broad bodies and curved, imposing mandibles used to capture and siphon body fluids from soft-bodied, phytophagous insects. Larval development requires three instars and about 15 to 20 days for completion, at which time a small silk capsule is constructed in which it pupates. Usually species pass through only one or two generations per year, and occasionally different species are restricted to particular vegetational substrates or altitudes.

KEY TO GENERA OF COSTA RICAN HEMEROBIIDAE

1. Forewing with two "radial sectors" (Figs. 507, 533) 2
1′. Forewing with three or more "radial sectors" (Figs. 445, 492) 3

2(1). Forewing with two gradate series (Fig. 533) . . . . *Sympherobius*
2′. Forewing with only one gradate series (Fig. 507) 6

3(1′). Forewing with two basal crossveins in subcostal space (Fig. 492) . . . . *Megalomus*
3′. Forewing with only one basal crossvein in subcostal space (Figs. 445, 530) 4

4(3′). Forewing with two crossveins between last "radial sector" and the radius (Fig. 445) . . . . *Hemerobius*
4′. Forewing with only one crossvein between last "radial sector" and the radius (Fig. 530) 5

5(4′). Forewing with three gradate series; MP fused with CuA (Fig. 530) . . . . *Nusalala*
5′. Forewing with two gradate series; MP connected to CuA by a crossvein (Fig. 504) . . . . *Micromus*

6(2′). First fork of first "radial sector" more distal than first fork of second "radial sector" . . . . *Biramis*
6′. First fork of first "radial sector" at same level as first fork of second "radial sector" . . . . *Notiobiella*

***Biramis* Oswald, 1993**

This genus was described in 1993 for a primitive species of hemerobiid from Venezuela. There is a second, as yet undescribed, species known from Costa Rica.

***Hemerobius* Linnaeus, 1758**

This genus is very speciose, with 144 species worldwide. It is the most widely distributed hemerobiid genus, being found on all continents except Antarctica, and many islands of the Indian, Atlantic and Pacific Oceans. Thirty species are known from Central and South America, with 11 species found in Costa Rica.

KEY TO COSTA RICAN *HEMEROBIUS*

1. Forewing with cubital cell open (Figs. 440, 446) 3
1′. Forewing with cubital cell closed (Figs. 441, 443) 2

2(1′). Male ectoproct with large ventral lobe (Fig. 457); entoprocesses widely separated at base and more than six times as long as wide (Fig. 459); with posterodistal margin nearly straight (Fig. 443) . . . . *H. discretus*
2′. Male ectoproct with very small ventral lobe (Fig. 474); entoprocesses close at base and only four times as long as wide (Fig. 476); forewing with posterodistal margin more convex (Fig. 448) . . . . *H. martinezae*

3(1). Forewing elliptical (width/length ratio ≈ 0.47), with at most 12 subcostal veinlets in the costal space before the pterostigma (Fig. 451) 4
3′. Forewing more elongate (width/length ratio ≈ 0.42), with more than 12 subcostal veinlets in the costal space before the pterostigma (Figs. 446) 7

4(3). Forewing with a dark brown spot over base of costal space (Fig. 451) . . . . *H. pennii*
4′. Forewing without dark brown spot over base of costal space (Fig. 452) 5

5(4′). Scape yellow, with a brown stripe on the external side; thorax dark brown without medial yellow band . . . . *H. withycombei*
5′. Scape yellow, without brown stripe on external surface; thorax dark brown with a medial yellow band 6

6(5′). Basal flagellomeres of antenna flattened (Fig. 439) in male; wings elliptical (width/length ratio = 0.45) (Fig. 450) . . . . *H. hirsuticornis*
6′. Basal flagellomeres of antenna normal in male; wings more oval (width/length ratio = 0.47) (Fig. 444) . . . . *H. edui*

7(3′). Thorax brown without a pale or yellow band over the central medial zone; pterostigma distinct (Fig. 449) . . . . *H. nigridorsus*
7′. Thorax brown with a pale or yellow band over the central medial zone; pterostigma inconspicuous 8

8(7′). Forewing with inner gradate veins aligned (Fig. 447) . . . . *H. jucundus*
8′. Forewing with inner gradate veins not aligned (Fig. 446) 9

9(8′). Forewing with the costal space strongly dilated basally (three times as wide basally as apically) (Fig. 446) . . . . *H. hernandezi*
9′. Forewing with costal space somewhat dilated basally (twice as wide basally as apically) (Fig. 445) 10

10(9). Head brown, with darker brown spots on the vertex, frons and external surface of scape . . . . *H. gaitoi*
10′. Head brown, without darker brown spots on the vertex, frons and external surface of scape . . . . *H. bolivari*

Hemerobius bolivari Banks, 1910
(Figs. 442, 453–456)

DIAGNOSIS. — This is one of the most variable species in the genus, both in size and pigmentation, in venation, and genitalia. The wings are lanceolate and basically brown colored, especially the forewings, with slightly darker markings along the gradates and basally. The male genitalia (Fig. 453–456) can help with differentiation.

GEOGRAPHICAL DISTRIBUTION. — A very broadly distributed species from Mexico, Guatemala, Costa Rica, Panama, Colombia, Venezuela, Ecuador, Peru, Bolivia, Paraguay, Brazil, Uruguay, Chile, and Argentina. In Costa Rica this species is known from: GUANACASTE, Cañas; Río Naranjo; PUNTARENAS, Monteverde; Bellavista; La Amistad National Park; Las Alturas; and SAN JOSÉ, Escazú.

ALTITUDINAL DISTRIBUTION. — Sea level to 3100 m, in Costa Rica to 1500 m.

Adult Flight Period. — This species has been collected in all months of the year; Costa Rican records are from January to June, September, and December.

Habitat Preference. — This species is known from a multitude of habitats, generally dry, sunny, open areas and frequently associated with human activity. They are usually found on trees.

Hemerobius discretus Navás, 1917

(Figs. 443, 457–459)

Diagnosis. — Large winged (forewing length 9.2–13.5 mm); this is one of the largest brown lacewings in Costa Rica. The forewings are highly variegated with brown, slightly lanceolate and with a straight posterodistal margin (Fig. 443). Females appear to be somewhat larger. The male external genitalia are unmistakable (Fig. 457–459).

Geographical Distribution. — U.S.A. (western), Mexico, Guatemala, Costa Rica, and Panama. In Costa Rica specimens have been encountered at: CARTAGO: Cartago; Chirripó; Parque Nacional Irazu; HEREDIA: Parque Nacional Braulio-Carrillo; SAN JOSÉ, San Gerardo de Dota, San José.

Altitudinal Distribution. — Mid-elevations from ca. 1200 to 3000 m.

Adult Flight Period. — February to December.

Habitat Preference. — Generally associated with dry and semiarid zones. Specimens have been collected on pines and with conifer pollen in their digestive tracts.

Hemerobius edui Monserrat, 1991

(Figs. 444, 460–462)

Diagnosis. — A small species with very rounded forewings, sparse, open venation and variegated brown markings (Fig. 444). It is easily differentiated by the male genitalia (Fig. 460–462).

Geographical Distribution. — This species is known from Mexico, Costa Rica, Colombia, and Peru. In Costa Rica collections are from: ALAJUELA: (without precise locality); GUANACASTE, Maritza Biological Station, southwest side of Orosí Volcano; Pitilla Biological Station, 7 km S Santa Cecilia; and PUNTARENAS, Monteverde.

Altitudinal Distribution. — 600–1500 m (Monteverde).

Adult Flight Period. — July to September.

Habitat Preference. — Subtropical moist forest.

Hemerobius gaitoi Monserrat, 1996

(Figs. 445, 463–466)

Diagnosis. — Somewhat variable in wing and integumentary coloration. It is easily recognizable by the pallid color of the forewings upon which are arranged two dark spots in the basal region (Fig. 445). The male gentialia (Figs. 463–466) can also serve to differentiate this species.

Geographical Distribution. — Widely distributed in the Neotropical Region: Mexico, Guatemala, Costa Rica, Dominican Republic, Venezuela, Ecuador, and Brazil. In Costa Rica it has been collected at: ALAJUELA (no further locality); PUNTARENAS, La Amistad National Park; Río Cotón; Río Bellavista.

Altitudinal Distribution. — 1000–2100 m.

Adult Flight Period. — February and April.

Habitat Preference. — Associated with trees in mountainous zones.

Hemerobius hernandezi Monserrat, 1996

(Figs. 446, 467–469)

DIAGNOSIS. — Easily recognized by its broad, oval, dark forewing, which is broadly expanded in the basal region of the costal space (Fig. 446). The male genitalia (Figs. 467–469) will also serve to identify this species.

GEOGRAPHICAL DISTRIBUTION. — Broadly distributed from Mexico, Guatemala, Nicaragua, Costa Rica, Panama, Colombia, Venezuela, Brazil, and Paraguay. In Costa Rica it has been frequently collected at: ALAJUELA, San Ramón Forest Reserve, Río San Lorencito; CARTAGO, Embalse El Llano; GUANACASTE, Río Naranjo; LIMÓN; PUNTARENAS, Monteverde; Irazú Vulcano; La Amistad National Park, Las Alturas; San Vito; and SAN JOSÉ, Est. Carara.

ALTITUDINAL DISTRIBUTION. — 1000–2200 m.

ADULT FLIGHT PERIOD. — In Costa Rica there appears to be a bimodal emergence pattern from January to June, and September to December.

HABITAT PREFERENCE. — Humid, forested zones.

Hemerobius hirsuticornis Monserrat, 1999

(Figs. 439, 450, 481–484)

DIAGNOSIS. — This small species has elliptical wings with variegated membrane (Fig. 450) and the males possess progressively swollen antennal segments in the basal third, forming a unique structure for this family (Fig. 439). Male genitalia with ectoprocts wide and bearing a preapical denticle (Figs. 481–484).

GEOGRAPHICAL DISTRIBUTION. — Described from Ecuador, it has been found in Mexico, Honduras, and Costa Rica. Within Costa Rica it is known only from PUNTARENAS: Monteverde.

ALTITUDINAL DISTRIBUTION. — Elevation ca. 1500 m.

ADULT FLIGHT PERIOD. — September.

HABITAT PREFERENCE. — The specimen from Monteverde was collected along the trails below the Pension Quetzal. This is a low, secondary, scrub forest along the margin of pastures. It is relatively open and subject to winds and rapidly changing temperatures.

Hemerobius jucundus Navás, 1927

(Figs. 447, 470–473)

DIAGNOSIS. — Easily recognizable by the gradate veins of the forewing, which are arranged in regular, aligned, step-wise progression (Fig. 447)—not in a broken line, as in other species. The male genitalia (Figs. 470–473) can also serve to differentiate this species.

GEOGRAPHICAL DISTRIBUTION. — Known from Mexico, Costa Rica, and Panama. In Costa Rica it has been collected at: CARTAGO, La Georgina; Villa Mills.

ALTITUDINAL DISTRIBUTION. — 1200–2740 m.

ADULT FLIGHT PERIOD. — March to May, and July to October. Within Costa Rica it has only been collected in August.

HABITAT PREFERENCE. — Associated with dry and semidesert zones.

Hemerobius martinezae Monserrat, 1996

(Figs. 448, 474–476)

DIAGNOSIS. — Brown head with darker stripes on the vertex and external surface of the antennal scape. Wings as in Figure 448. The male genitalia are unmistakable (Figs. 474–476).

Geographical Distribution. — Mexico, Guatemala, and Costa Rica. In Costa Rica it is abundant, collected at: CARTAGO, Irazú Vulcano; HEREDIA, Est. Barva; PUNTARENAS, La Amistad National Park; Las Alturas; and Las Tablas.

Altitudinal Distribution. — High elevations up to 2900 m, most common at about 2000 m.

Adult Flight Period. — This species can be collected at all times of year, and in Costa Rica has been taken from December to April, June, and October.

Habitat Preference. — Associated with montane forest vegetation, frequently in oak (*Quercus*) forests.

***Hemerobius nigridorsus* Monserrat, 1996**
(Figs. 449, 477–480)

Diagnosis. — Easily recognized by the dark brown pterostigma (Fig. 449), and the dorsal region of the thorax without a medial yellow band, as in the other species. The male genitalia (Figs. 477–480) will also serve to differentiate this species.

Geographical Distribution. — Known only from Costa Rica: PUNTARENAS, La Amistad National Park, Las Alturas.

Altitudinal Distribution. — 1500–1600 m.

Adult Flight Period. — February and March.

Habitat Preference. — Collected on understory saplings, including many *Peperonia* plants, in mixed montane primary forest with many large *Ficus* trees at a dry period of the year in a mountainous rain shadow area.

***Hemerobius pennii* Monserrat, 1996**
(Figs. 451, 485–488)

Diagnosis. — Very small species (5 mm forewing length), characterized by spots on the forewing which extend to the costal field (Fig. 451). The species is also easily distinguished by the male genitalia (Figs. 485–488).

Geographical Distribution. — Known from Costa Rica and Ecuador. In Costa Rica it is known from: ALAJUELA, 20 km S Upala; PUNTARENAS, La Amistad National Park, Las Alturas.

Altitudinal Distribution. — 870–1500 m.

Adult Flight Period. — February to July.

Habitat Preference. — Collected from understory saplings, including many *Peperonia* plants, in mature montane primary forest with many large *Ficus* trees at a dry period of the year in a mountainous rain shadow area.

***Hemerobius tibialis* Navás, 1917**

This species was originally described from Colombia and subsequently reported from Costa Rica. However, the original description included few distinguishing characteristics and the type (in the Apolinar Collection in Bogota, Colombia) was destoyed in a fire in 1948. This species must currently be considered a *nomen dubium*. For a fuller discussion of this species see Monserrat (1996).

***Hemerobius withycombei* (Kimmins, 1928)**
(Figs. 452, 489–491)

Diagnosis. — Very rounded wings with sparse, open venation and very little pigmentation, except at the pterostigma, which is very dark and distinctive (Fig. 452). The body coloration is pale brown and emphasizes the yellow antennae with lateral brown band on the scape. Male genitalia as in Figs. 489–491.

GEOGRAPHICAL DISTRIBUTION. — Known from Mexico, Costa Rica, and Colombia. In Costa Rica this species has been collected at: GUANACASTE, Maritza Biological Station, southwest side of Orosí Vulcano.

ALTITUDINAL DISTRIBUTION. — 550 m.

ADULT FLIGHT PERIOD. — March to September elsewhere, but only in July in Costa Rica.

HABITAT PREFERENCE. — Mature forests, probably associated with conifers.

Megalomus Rambur, 1842

This genus contains about 40 known species. It is widely distributed in Europe, North Africa, the Americas and Palearctic Asia, sparsely distributed in Oriental Asia (Taiwan and India) and is absent from the Afrotropical and Australian Regions. *Megalomus* is broadly distributed in Central and South America, with two species in Costa Rica.

KEY TO COSTA RICAN *MEGALOMUS*

1. Hind wing with MA reaching Rs_1 before its first fork (Fig. 494); forewing ovoid, with 4–5 radial sectors; first subcostal crossvein very oblique with respect to the second (Fig. 492) . . . . *M. minor*

1′. Hind wing with MA reaching Rs_1 after its first fork (Fig. 495); forewing apically tapered, even falcate, with 9–11 radial sectors; first subcostal crossvein parallel to the second (Fig. 493) . . . . *M. pictus*

Megalomus minor Banks, 1905
(Figs. 492, 494, 496–499)

DIAGNOSIS. — A small species with pale integument and pale antennae, and generally with scape and pedicel darker externally. Forewings elliptical, rounded at its apex, with the first crossvein of the subcostal field oblique (Fig. 492), membrane pale with variegations and dispersed darker spots. Male genitalia as in Figures 496–499.

GEOGRAPHICAL DISTRIBUTION. — Widely distributed around the Caribbean, northward to U.S.A. (AL, CA, MS, NV, see Penny et al. 1997) southward to Colombia. Within Costa Rica it has been collected in all provinces: ALAJUELA, CARTAGO, GUANACASTE, HEREDIA, LIMÓN, PUNTARENAS, and SAN JOSÉ.

ALTITUDINAL DISTRIBUTION. — Within Costa Rica this species has been collected at 200, 680–700, and 1400 m. It has been collected from sea level to 1400 m in extralimital areas.

ADULT FLIGHT PERIOD. — Adults present year round, but in Costa Rica are most abundant from February to April.

HABITAT PREFERENCE. — Open fields and grasslands, also in tropical forest zones and coffee plantations.

Megalomus pictus Hagen, 1861
(Figs. 493, 495, 500–503)

DIAGNOSIS. — A large species (10–12 mm forewing length) with dark brown integument and brown antennae. Forewings somewhat pointed, in some specimens even markedly falcate, with the crossveins of the subcostal field parallel (Fig. 493), pale membrane in some specimens, with much variegation and brown spots in others. Male genitalia as in Figures 500–503.

GEOGRAPHICAL DISTRIBUTION. — Widely distributed in Central America (Mexico, Guatemala, Honduras, and Costa Rica). In Costa Rica it has been collected at the Irazú Volcano.

ALTITUDINAL DISTRIBUTION. — 2200 m and 2590–3200 m.

ADULT FLIGHT PERIOD. — February, June to July, and December elsewhere. In Costa Rica adults are known from December.

HABITAT PREFERENCE. — Probably montane tropical forest. Recorded on *Pinus*, with coniferous pollen in its digestive tract.

Micromus Rambur, 1842

This is a genus of about 100 described species, with an almost cosmopolitan distribution (Europe, Asia, Africa, North and Central America, Australia, and many islands in the Atlantic, Pacific and Indian oceans). In North America, eight species are recognized, some of which reach Mexico and the Caribbean. Earlier records of this genus from South America pertain to *Nusalala* Navás and there appear to be no confirmed species from that continent. Only one species occurs in Costa Rica.

Micromus subanticus (Walker, 1853)

(Figs. 504–506)

DIAGNOSIS. — A small, pale brown species, vertex pale with brown spots on both sides and thorax with paler median stripe. Forewing (Fig. 504) elongate, narrow and pale brown, with a few small brown spots (forewing length 4.5–7.5 mm, hind wing length 4.0–5.5 mm). Male ectoproct and internal genitalia (Figs. 505, 506). The morphology was described in detail by Klimaszewski and Kevan (1988).

GEOGRAPHICAL DISTRIBUTION. — A transcontinental species widely distributed in North America (from southern Canada to Mexico), as well as the Dominican Republic, Haiti and Cuba. Previously unknown from Costa Rica, it is here reported from: ALAJUELA: Upala; GUANACASTE: Cañas and Río Naranjo; and PUNTARENAS: San Vito.

ALTITUDINAL DISTRIBUTION. — Sea level to about 1200 m.

ADULT FLIGHT PERIOD. — Collected throughout the summer months in temperate climates. In Costa Rica records are from all months except June, July, and October.

HABITAT PREFERENCE. — Open and mixed forest fields, on birch, vineyards, citrus, alfalfa fields, but primarily on grass and low vegetation. Information on biology was outlined in Klimaszewski and Kevan (1988). Usually collected at lights.

Notiobiella Banks, 1909

This genus has a pan-tropical distribution (Central and South America, sub-Saharan Africa, Southeast Asia, Australia and the Southwestern Pacific) with ca. 35 known species. In the Americas eight species are known, distributed from Mexico, Central America, and the Caribbean south to Brazil, Argentina, and Paraguay. Within Costa Rica two species are known.

KEY TO MALES OF COSTA RICAN *NOTIOBIELLA*

1. Membranous formations of male internal genitalia lacking chitinous denticles (Figs. 508, 510) . . . . . *N. rubrostigma*
1′. Membranous formations of male internal genital possessing chitinous denticles (Figs. 512–514) . . . . . . *N. mexicana*

Notiobiella mexicana Banks, 1913
(Figs. 511–514)

DIAGNOSIS. — This is a pale brown species. Wing venation pale brown with forewing longitudinal vein forks and gradate veins darker (Fig. 511). External morphological characters are somewhat variable and examination of the male genitalia (Figs. 512–514) is needed for reliable identification. The morphology and genitalia were treated by Monserrat (1984).

GEOGRAPHICAL DISTRIBUTION. — Previously known only from Mexico (San Luis Potosí and Guadalajara). Reported here from Costa Rica: GUANACASTE: Cañas, where it appears quite common.

ALTITUDINAL DISTRIBUTION. — Sea level to more than 1000 m.

ADULT FLIGHT PERIOD. — Costa Rican specimens have been collected in January, February, July, and September.

HABITAT PREFERENCE. — It appears to inhabit sunny areas and is frequently collected at lights.

Notiobiella rubrostigma Navás, 1914
(Figs. 507–510)

DIAGNOSIS. — This species is very similar to *N. mexicana* in external morphology, pigmentation and venation (Fig. 507), and the external morphological characters mentioned in the identification key need to be confirmed with examination of the male genitalia (Figs. 508–510) for confident identification. The morphology and genitalia were treated by Monserrat (1984).

GEOGRAPHICAL DISTRIBUTION. — Widely distributed in the neotropical region: Mexico, El Salvador, Honduras, Panama, Colombia, Venezuela, Bolivia, Peru, Brazil, Paraguay, and Argentina. Previously unknown from Costa Rica, but here recorded from GUANACASTE: Río Naranjo; and SAN JOSÉ: La Hermosa.

ALTITUDINAL DISTRIBUTION. — Sea level to 1000 m.

ADULT FLIGHT PERIOD. — Individuals have been collected throughout the year (January to April, July to September, and November) in other parts of its range; reported in Costa Rica from January, February, April, August, and September.

HABITAT PREFERENCE. — Humid zones to open and sunny areas, usually in arboreal vegetation.

Nusalala Navás, 1913

A Neotropical genus with 17 valid species. It is known from southern Mexico, Central America, the Caribbean Islands (where it is especially rich in species), and South America (though absent in most of Amazonia and the southern cone). Replaces *Micromus* in South America and is a common tropical element. In Costa Rica *Nusalala* is represented by seven species.

KEY TO COSTA RICAN *NUSALALA*

1. Forewing coriaceous and brachypterous, hind wing tiny and scalelike . . . . *N. brachyptera*
1′. Both fore- and hind wing membranous and extending beyond abdomen 2

2(1′). Costal space of forewing basally with crossveins present (Fig. 521); male genitalia (Figs. 522–523) . . . *N. irrebita*
2′. Costal space of forewing with crossveins absent (Fig. 527) 3

3(2′). Forewing with a dark line through all three gradate series and with a medial dark longitudinal stripe (Fig. 527); male genitalia (Figs. 528–529) . . . . *N. uncata*
3′. Without these wing markings 4

4(3′). Forewing with distinct dark spots (Figs. 515, 530) 5
4′. Forewing without distinct dark spots (Figs. 518, 524) 6

5(4). Forewing subtriangular (Fig. 515), width/length ratio = 0.40; male genitalia (Figs. 516–517) . . . . . . *N. championi*
5′. Forewing elongated (Fig. 530), width/length ratio = 0.36; male genitalia (Figs. 531–532) . . . . . . *N. unguicaudata*

6(4′). Forewing with external gradates darker than the other series (Fig. 524). Male genitalia (Figs. 525–526) . *N. tessellata*
6′. Forewing with mid- and external gradate series darker than inner one (Fig. 518). Male genitalia (Fig. 519–520) . . . . *N. ghioi*

Nusalala brachytpera Oswald, 1996
(Fig. 514a-c)

DIAGNOSIS. — This species can be distinguished from other species of *Nusalala* by the coriaceous and brachypterous forewing, the highly reduced and scalelike hind wing, and the posteroventral spine on the male ectoproct.

GEOGRAPHICAL DISTRIBUTION. — Known only from four localities in Costa Rica: CARTAGO: Villa Mills, km 97.5 Inter-American Highway, R. K. Colwell, 1 male (Oswald Coll.); km 97 on Cerro de la Muerte, M. L. Jameson , 1 male (CAS); 5 km (3 mi) south Empalme, O'Brien, O'Brien, and Marshall, 1 female (CAS); SAN JOSÉ: 46.7 km (29 mi) north of San Isidro del General, C. W. and L. B. O'Brien, 1 male (CAS).

ALTITUDINAL DISTRIBUTION. — 2620–3350 m.

ADULT FLIGHT PERIOD. — May to July.

HABITAT PREFERENCE. — At least some of the specimens have been collected by beating the low vegetation of the high altitude "paramo."

REMARKS. — Although this species appears very distinctive, we have seen female specimens of what may be a second, related species of brachypterous *Nusalala*.

Nusalala colombiensis (Banks, 1910)

DIAGNOSIS. — This species has only 3 to 4 branches of the "Rs" and the forewing is apically lanceolate and pointed with a longitudinal, dark stripe in the middle. These characters will separate this species from all others known from Costa Rica.

GEOGRAPHICAL DISTRIBUTION. — Originally described from COLOMBIA; here reported from Costa Rica: SAN JOSÉ: Zurqui de Moravia, 1 female (TAMU).

ALTITUDINAL DISTRIBUTION. — 1600 m.

ADULT FLIGHT PERIOD. — September.

HABITAT PREFERENCE. — Unknown.

Nusalala championi Kimmins, 1937
(Figs. 515–517)

DIAGNOSIS. — A large, dark brown spotted species. Fore- and mid-femora and tibiae with two dark preapical spots. Forewing (Fig. 515) wide, broader at mid-length, and somewhat acute at apex, hind wing pale brown with darker external gradates, forewing with 5–7 "radial sectors," dark variegated and irregularly dark dotted, usually with dark dots on medial and outer gradates (forewing length 9–11 mm, hind wing length 7–9 mm). Male ectoproct and internal genitalia (Figs. 516–517).

GEOGRAPHICAL DISTRIBUTION. — Known only from Mexico, Guatemala, Costa Rica, and Panama. Within Costa Rica it has been collected in ALAJUELA: San Ramón: CARTAGO: Turrialba; and PUNTARENAS: Monteverde.

ALTITUDINAL DISTRIBUTION. — 1400 to 1520 m in Costa Rica.

ADULT FLIGHT PERIOD. — Collected during the first seven months of the year over its full range. Within Costa Rica, collected from January to March, and June to July.

HABITAT PREFERENCE. — This species seems to prefer woodlands. It has been collected in dry forest, tropical rainforest and riverine vegetation. It has also been collected with the aid of light and Malaise traps.

Nusalala ghioi Monserrat, 2000

(Figs. 518–520)

DIAGNOSIS. — A medium to large-sized brown species. Fore- and mid-tibiae with two dark preapical spots. Forewing (Fig. 518) wide, subtriangular and somewhat acute at apex. Forewing completely dark variegated, with hexagonal cells between gradates and medial and outer gradates darker than inner (forewing length 10–12 mm, hind wing length 9–11 mm). Male ectoproct and internal genitalia (Figs. 519–520).

GEOGRAPHICAL DISTRIBUTION. — A widely distributed species in Central America (Mexico, Guatemala, Honduras, and Costa Rica). Within Costa Rica it has been collected in ALAJUELA: Zarcero, and SAN JOSÉ: San Gerardo and Irazú.

ALTITUDINAL DISTRIBUTION. — Probably orophilous, 1520 to 3420 m. In Costa Rica, from 1000 to 2500 m.

ADULT FLIGHT PERIOD. — Collected from February to August, and November to December. Costa Rican records are for February, April, May, and December.

HABITAT PREFERENCE. — This species appears to prefer forests. Collected in wet woodlands and mixed tropical forest. Also collected with lights and Malaise traps.

Nusalala irrebita (Navás, 1929)

(Figs. 521–523)

DIAGNOSIS. — A large, pale brown species. Fore- and mid-femora and tibiae with two dark preapical spots. Forewing (Fig. 521) widely subtriangular with somewhat acute apex, forewings pale brown to dark variegated, with hexagonal cells between gradates and easy to distinguish due to two series of cells in its costal field (forewing length 8–10 mm, hind wing length 6–8 mm). Male ectoproct and internal genitalia (Figs. 522–523).

GEOGRAPHICAL DISTRIBUTION. — Central America, rarely and only recorded from Mexico, Honduras, El Salvador, Nicaragua, Costa Rica, and Panama. Within Costa Rica it has been collected in PUNTARENAS: Monteverde; and SAN JOSÉ: Escazú.

ALTITUDINAL DISTRIBUTION. — 1300 to 1600 m in Costa Rica.

ADULT FLIGHT PERIOD. — Collected during almost the entire year (January, February, April to September). Within Costa Rica collected in January, May, and September.

HABITAT PREFERENCE. — Rarely collected. Usually on vegetation in mixed forest and wet woodlands. Also collected at lights.

Nusalala marginata Navás, 1926

This species was described from Costa Rica and subsequently reported from Mexico. Unfortunately, from the original description it is not possible to assign this species to any known taxon in the region and this species must be currently considered a *nomen dubium*.

Nusalala tessellata (Gerstaecker, 1888)
(Figs. 524–526)

Diagnosis. — A medium-sized, pale brown species. Fore- and mid-tibiae with two dark preapical spots. Wings (Fig. 524) subtriangular and somewhat acute at apex, pale brown, forewing with darker variegated pattern, with hexagonal cells among gradates and darker external gradates (forewing length 7–9 mm, hind wing length 6–7 mm). Male ectoproct and internal genitalia (Figs. 525–526).

Geographical Distribution. — A widely distributed species, broadly recorded in Central America (Mexico, Guatemala, Honduras, Panama, Dominica, Virgin Islands, and Puerto Rico) and South America (Colombia, Venezuela, Ecuador, Peru, Bolivia, Brazil, Paraguay, and Argentina). Previously unknown from Costa Rica, where it has been amply collected in ALAJUELA: Upala; Irazú; Zarcero; GUANACASTE: Cañas; Río Naranjo; Santa Cecilia; San Lorenzo; and SAN JOSÉ: Escazú.

Altitudinal Distribution. — Sea level to 1900 m; in Costa Rica from 400 to 1700 m.

Adult Flight Period. — This species has been collected throughout the year. Within Costa Rica, collecting records appear bimodal from January to May, and August to December, being especially abundant from February to March, and November to December.

Habitat Preference. — This appears to be a generalist species. Collected in open and mixed forest and fields, wet woodlands, savannas, on citrus, coffee, grasses and riverine vegetation. It has also been collected at dusk and with the aid of light and Malaise traps.

Nusalala uncata Kimmins, 1937
(Figs. 527–529)

Diagnosis. — A medium to large-sized, brown species. Fore- and mid-femora with a basal dark spot and fore- and mid-tibiae with two dark preapical spots. Wings (Fig. 527) wide, subtriangular and somewhat acute at apex, forewing darker than other species, fully dark variegated, with three dark bands along the gradates and a longitudinal dark stripe joining them. Hind wings paler with dark external gradates (forewing length 7–9 mm, hind wing length 6–8 mm). Male ectoproct and internal genitalia (Figs. 528–529).

Geographical Distribution. — Known only from Costa Rica and Panama. Within Costa Rica it has been collected in CARTAGO: Quebrada Segunda; GUANACASTE; PUNTARENAS: Las Alturas; Monteverde; and SAN JOSÉ: San Isidro del General; Escazú; Irazú.

Altitudinal Distribution. — Usually found at mid-elevation (610–2135 m). In Costa Rica mostly found from 1100 to 1520 m and in Panama from 610 to 910 m.

Adult Flight Period. — February, May to July, and September to October.

Habitat Preference. — This species appears associated with moist woodlands. It has been collected in wet forests and mixed tropical forest. It is attracted to lights.

Nusalala unguicaudata Monserrat, 2000
(Figs. 530–532)

Diagnosis. — A medium-sized, pale brown species. Forefemora with two preapical dark spots and fore- and mid-tibiae with two dark preapical spots. Forewing (Fig. 530) very elongated and with acute apex, pale brown, forewing somewhat darkly variegated, with elongated cells between gradates and dark margining on medial and outer gradates (forewing length 8–10 mm, hind wing length 7–8 mm). Male ectoproct and internal genitalia (Figs. 531–532).

Geographical Distribution. — Known only from Central America (Mexico, Guatemala, and Costa Rica), where it has been collected in GUANACASTE: Río Naranjo; ALAJUELA: Upala; and PUNTARENAS: Las Alturas.

Altitudinal Distribution. — Elevation ca.1500 m.

Adult Flight Period. — March, June, August, October, and December. Within Costa Rica collected only in the latter part of the year from August, October, and December.

Habitat Preference. — Unknown. Mostly collected with light traps.

Sympherobius Banks, 1904

This genus contains almost 60 valid species, widely distributed in Europe, western, northern and central Asia, throughout the Americas, and northern, eastern, and southern Africa. The species from America, north of Mexico, were revised by Oswald (1988) who also presented a world list of species.

Some of the previously described species from Central and South America are poorly known, and probably new synonymies will be discovered. Our knowledge of Central American species is still incomplete and new distribution records will certainly appear. Some of the species recorded here were previously unknown from Central America, especially Costa Rica, where four species have now been recorded.

KEY TO COSTA RICAN *SYMPHEROBIUS*

Note: Other species which may subsequently be found in Costa Rica include: *S. perparvus* (McLachlan, 1869), *S. barberi* (Banks, 1903) and *S. marginatus* (Kimmins, 1928).

1. Forewing without a crossvein connecting R_{4+5} with R_1 or R_{2+3} (Fig. 534) . . . . *S. arizonicus*
1′. Forewing with a crossvein connecting R_{4+5} with R_1 or R_{2+3} (Figs. 533, 536) 2

2(1′). Forewing ovoid, with a dark spot basally in the subcostal space, outer gradate series especially darker than others, and with a crossvein between R_{4+5} and R_{2+3} (Fig. 536) . . . . *S. subcostalis*
2′. Forewing elongate, without a dark spot on the basal subcostal space; outer gradate series not especially darker than other crossveins, and with a crossvein between R_{4+5} and R_1 (Figs. 533, 535) 3

3(2′). Longitudinal veins in forewing nearly concolorous brown, without alternating dark-hyaline segments (Fig. 535) . . . . *S. similis*
3′. Longitudinal veins in forewing with alternating dark-hyaline segments . . . . *S. angustus*

Sympherobius angustus (Banks, 1904)
(Fig. 533)

Diagnosis. — A small and variable pale brown species with brown antennae and forewings pale and diffusely variegated, with darker stripe on Cu_1; longitudinal veins alternating dark and hyaline, and bearing a crossvein between fork of R_{4+5} and R_1 (Fig. 533). Forewing length 4.5–6.5 mm, hind wing length 3.3–5.3 mm. Body and genital morphology in Oswald (1988).

Geographical Distribution. — This species is known from Canada (British Columbia), western U.S.A. (AZ, CA, NM, CO, ID, NV, OR, SD, TX, UT) and Mexico (Coahuila, Distrito Federal, Durango, Guanajuato, Jalisco, Michoacán, Nuevo León, Oaxaca). In Central America, it has only been collected in Costa Rica: ALAJUELA: Zarcero.

Altitudinal Distribution. — 1100–2900 m. Within Costa Rica, it is known from 1700 m.

Adult Flight Period. — From April to August, and October. Within Costa Rica it has been collected in April and May.

HABITAT PREFERENCE. — This species appears to be associated with montane forests. They are mainly collected at light traps.

Sympherobius arizonicus Banks, 1911
(Figs. 534)

DIAGNOSIS. — This is a small, pale brown species with dark brown antennae and brown variegated forewings, with darker crossveins and without a crossvein between R_{4+5} and R_{2+3} or R_1 (Fig. 534). Forewing length 2.5–4.5 mm, hind wing length 3.2–5.2 mm. Body and genital morphology in Oswald (1988).

GEOGRAPHICAL DISTRIBUTION. — Known from U.S.A. (AZ, CA) and Mexico (Baja California, Oaxaca, Puebla, and Sonora). In Central America this species is only known from Costa Rica, where it has been collected at: GUANACASTE: Cañas Experimental Station (14 km SW Cañas); and Santa Rosa National Park.

ALTITUDINAL DISTRIBUTION. — Generally found at low elevations (30–1630 m). Within Costa Rica it has been collected at 10 m.

ADULT FLIGHT PERIOD. — All months of the year. Within Costa Rica collection dates are January and March through September.

HABITAT PREFERENCE. — Unknown. Usually collected at light traps.

Sympherobius similis Carpenter, 1940
(Fig. 535)

DIAGNOSIS. — A small, pale brown species with dark brown antennal flagellum and paler scape and pedicel. Forewings alternating pale and dark variegations, with darker crossveins and bearing a crossvein between R_{4+5} and R_1. Longitudinal veins almost uniformly dark brown and bearing a dark oblique stripe on Cu_1 (Fig. 535). Forewing length 3.3–4.3 mm, hind wing length 2.7–3.7 mm. Body and genital morphology in Oswald (1988).

GEOGRAPHICAL DISTRIBUTION. — Previously known only from U.S.A. (AZ), it is herein recorded for the first time from Mexico (Chiapas, Michoacán, Morelos, Nuevo León, and Veracruz) and Central America (Costa Rica and Panama). Within Costa Rica this species has been collected from GUANACASTE: Río Naranjo; and HEREDIA: Santo Domingo.

ALTITUDINAL DISTRIBUTION. — In Panama at 1300 m. The Río Naranjo locality is near sea level, while Santo Domingo de Heredia is in the central valley near San José at above 1000 m.

ADULT FLIGHT PERIOD. — January, April, June, and July. Within Costa Rica it has been collected in January and April.

HABITAT PREFERENCE. — Unknown. Mostly collected at light traps.

REMARKS. — Previous records of *Sympherobius miranda* (Navás, 1920) in Costa Rica (Monserrat 1990) pertain to this species.

Sympherobius subcostalis Monserrat, 1990
(Fig. 536)

DIAGNOSIS. — A small pale brown species with pale flagellum, but darker brown on segments 10 to 15. Forewings oval, the external crossveins darker, with a dark spot on the basal subcostal crossvein, and a crossvein between R_{4+5} and R_{2+3} (Fig. 536). Forewing length 3.5–4.5 mm, hind wing length 3.0–4.0 mm. Body and genital morphology in Monserrat (1990).

Geographical Distribution. — Known from Mexico (Chiapas, Jalisco, Veracruz, and Yucatán) and Central America (Nicaragua and Costa Rica). It has also been recorded from Colombia. Within Costa Rica it has been collected in abundance in GUANACASTE: Cañas; and Río Naranjo.

Altitudinal Distribution. — 230 to 630 m. The Cañas and Río Naranjo localities are at low elevations in flat to rolling hills of agricultural lands.

Adult Flight Period. — Outside Costa Rica from January, May, June, and August. Within Costa Rica from January to June, September, October, and December.

Habitat Preference. — Unknown. Mostly collected at light traps and in forests. Some specimens have been collected on citrus and *Clerodendrum*.

Family Mantispidae

by
Kevin Hoffman

Adults of the family Mantispidae are sometimes called mantisflies because of the combination of an elongate prothorax and raptorial prolegs, which causes adults to resemble small praying mantises. The family is divided into four subfamilies, three of which occur in Costa Rica. Adult mantispids are mostly predators of small insects, however, some species also feed on plant exudates and at floral and extrafloral nectaries. Many species are attracted to lights at night, while others are primarily diurnal and can be found on or near flowers. Larvae are predators of sedentary arthropods and spider eggs. Cocoons are constructed in association with the larval food source by using silk spun through an anal spinneret. The exarate pupae exit cocoons by chewing holes in them with decticious mandibles and may wander some distance before adult eclosion. Eighteen species are known from Costa Rica. An additional species is included in the following treatment because it is distributed in the region and therefore will most likely be collected in Costa Rica in the future.

Key to Genera of North and Central American Mantispidae

1. Prolegs each with two pretarsal claws and a median arolium (Figs. 538–540); head with vertex domed in frontal view (Figs. 548–550) 2
1′. Prolegs each with one tarsal claw and no arolium (Fig. 541); head with vertex concave in frontal view (Fig. 551) . . . . Subfamily Mantispinae 4

2(1). Pronotum at least twice as long as high in lateral view (Fig. 555); basal tarsomere of protarsus without dentiform process (Fig. 540); wing with pterostigmal spot semicircular, entirely dark (Fig. 544). . . . . . Subfamily Calomantispinae . . . . *Nolima*
2′. Pronotum only slightly longer than high in lateral view (Figs. 553, 554); basal tarsomere of protarsus with lanceolate process (Figs. 538, 539); wing with pterostigmal spot elongate, dark with middle pale (Figs. 542, 543). . . . . Subfamily Symphrasinae 3

3(2′). Profemur with sub-basal spine (Fig. 538) . . . . *Plega*
3′. Profemur without sub-basal spine (Fig. 539) . . . . *Trichoscelia*

4(1′). Antennal flagellomeres at mid-length of flagellum each three or more times as wide as long in anterior view (Figs. 563–567); mesoscutal furrow obsolete (Figs. 558–562); forewing with anterior half pale amber to dark brown (Figs. 545–547) . . . . *Climaciella*
4′. Antennal flagellomeres at mid-length of flagellum less than three times as wide as long in anterior view; mesoscutal furrow conspicuous (Figs. 555–557); forewing with anterior half hyaline 5

5(4′). Pronotum with prominent setae over entire length in lateral view (Figs. 608, 609) 6
5′. Pronotum with scattered fine setae in lateral view, most setae at anterior and posterior ends (Figs. 606, 607) . . . 9

6(5). Pronotum with most setae arising from distinct bumps (Fig. 609); forewing with Sc distal to sc-ra at 30° angle to RA (Fig. 589–591) . . . . *Zeugomantispa*
6′. Pronotum with most setae arising flush with pronotal surface (Fig. 608); forewing with Sc distal to sc-ra at 40–50° angle to RA (Fig. 569) 7

7(6′). Pronotum 4.4–5.0 times as long as wide at maculae; forewing with membrane around 1ra-rp and 2ra-rp amber to light brown; male abdomen with long setae emanating from pores on tergites IV-V anterolaterally; pseudopenis broadly triangular and as wide as pseudopenal membrane; female spermatheca with proximal section distinctly wider than medial section . . . . *Xeromantispa*
7′. Pronotum 5.5–9.0 times as long as wide at maculae; forewing with membrane around 1ra-rp and 2ra-rp hyaline; male abdomen without long setae emanating from pores on tergites IV-V; pseudopenis spinelike in posterior view; female spermatheca with proximal section as wide as, or narrower than, medial section 8

8(7′). Forewing with amber infuscation posterior to 1MP (Fig. 569); body mostly dark red . . . . . . *Haematomantispa*
8′. Forewing without amber infuscation posterior to 1MP (Figs. 586–588); body mostly a mixture of yellow and brown . . . . *Leptomantispa*

9(5′). Head with inverted V-shaped mark directly beneath antennae (Fig. 552); wing apex infuscated (Fig. 568); body coloration mottled, camouflage-like . . . . *Buyda*
9′. Head with either longitudinal or transverse stripe beneath antennae (Fig. 579); wing apex unmarked; body coloration varied 10

10(9′). Head mostly brown above antennae (Fig. 582); mesonotum with paired longitudinal yellow stripes laterally (Fig. 583), mostly brown anterior to mesoscutal furrow; forewing with basal third of cell 1RA hyaline (Fig. 572) . . . . *Dicromantispa*
10′. Head yellow with transverse brown stripes above and beneath antennae (Fig. 551); mesonotum with paired yellow stripes angled from wing bases to scutellum (Fig. 556), almost entirely yellow anterior to mesoscutal furrow; forewing usually with basal third of cell 1RA amber (Fig. 570) . . . . *Entanoneura*

SUBFAMILY CALOMANTISPINAE

This subfamily contains two genera, one of which occurs in Costa Rica. Little is known of their life histories. The only rearings of a calomantispine are of *Nolima pinal* Rehn from the southwestern United States (MacLeod and Redborg 1982). Larvae fed on Coleoptera larvae and pupae, Lepidoptera pupae, aculeate Hymenoptera larvae, Diptera pupae, and the eggs and paralyzed adults of spiders. The immature stages were not described, but all three larval instars were fully ambulatory and conceivably could feed on several different prey items during the larval life span.

Nolima Navás, 1914

Nolima contains seven species, one of which occurs in Costa Rica.

Nolima infensus Navás, 1924
(Figs. 540, 544, 550, 555)

DIAGNOSIS. — *Nolima infensus* can be separated from other Costa Rican mantispids by the dark, semicircular, pterostigmal spot on each wing. In addition, this species has each protarsus with two pretarsal claws and a median arolium and lacks a dentiform process on the basal tarsomere.

GEOGRAPHICAL DISTRIBUTION. — This species is known only from Costa Rica. It was described by Navás (1924) from an unspecified locality, and has since been collected in the province of San José. The specific locality is as follows: SAN JOSÉ: Escazú.

ALTITUDINAL DISTRIBUTION. — Unknown.

ADULT FLIGHT PERIOD. — July.

HABITAT PREFERENCE. — Unknown.

SUBFAMILY MANTISPINAE

Fifteen species are presently known to occur in Costa Rica. The following information on the subfamily is excerpted from the work by Hoffman (1992). Adults have been reared exclusively from the egg sacs of spiders. Larvae feed on eggs by piercing the chorion and draining the contents, and have been noted to feed on neonate spiderlings as well. Larvae have three instars and are hypermetamorphic with the first instar campodeiform and the last two scarabaeiform. Female mantispines lay clutches of approximately 200 to 2000 individually stalked eggs on objects such as leaves, twigs, branches, wooden structures, and iron poles. Following eclosion, first-instar mantispines must locate spider egg sacs and gain access to the eggs within. The two general methods used by larvae to gain access to eggs are either to locate and enter preexisting egg sacs or to locate and board female spiders and enter egg sacs as they are deposited. Different mantispine species may use one of these two strategies exclusively or either strategy facultatively. Larvae aboard spiders generally are found either wrapped around the pedicel, inside the book lung openings, or attached to the membranous area between the edge of the carapace and the base of the legs; such larvae have survived for months apparently by feeding on spider haemolymph and can be considered true ectoparasites at this stage in their life cycle.

Buyda Navás, 1926

This genus contains two species occurring from Honduras to northern Argentina, one of which is known from Costa Rica. The immature stages are unknown.

Buyda phthisica (Gerstaecker, 1885) [new combination]
(Figs. 552, 557, 568, 606)

DIAGNOSIS. — *Buyda phthisica* can be separated from other Costa Rican mantispines by the combination of an inverted V-shaped mark directly beneath the antennae, the infuscated wing tips, and the mottled, camouflage-like body coloration.

GEOGRAPHICAL DISTRIBUTION. — This species occurs from Honduras to northern Argentina. Within Costa Rica, specific localities are as follows: CARTAGO: Turrialba; near Turrialba; HEREDIA: Chilamante; La Selva Biological Station, 3 km S Puerto Viejo, 10°26′N, 84°01′W; Finca La Selva, 4 km SE Puerto Viejo de Sarapiqui; LIMÓN: Hacienda Tapezco, 29 air km W Tortuguero, 10°30′N, 83°47′W; Río Banano, 16 km WSW Bomba, 9.888°N, 83.167°W; Río Uatsi, 8 km (air) W Bribri, 9.62°N, 82.90°W; PUNTARENAS: Osa Peninsula, 2.9 km (1.8 mi) W Rincón.

ALTITUDINAL DISTRIBUTION. — 40–150 m.

ADULT FLIGHT PERIOD. — February to June, and October.

HABITAT PREFERENCE. — Unknown.

Climaciella Enderlein, 1910

This genus contains nine species found from southern Canada to northern Argentina, including the Caribbean islands of Cuba, Hispaniola, and Puerto Rico. Three species occur in Costa Rica. All of the species are somewhat wasplike in appearance, and can be easily distinguished from other Costa Rican mantispines by wings that have the anterior half amber to dark brown. Adults of *Climaciella brunnea* (Say), which occurs in Costa Rica, are diurnal and commonly found on various flowers. The immature stages of *C. brunnea* have been associated with four species of wolf spiders (Lycosidae), and first instars have been described.

KEY TO COSTA RICAN *CLIMACIELLA*

1. Pronotum distinctly bent ventrad at mid-length in lateral view (Fig. 605); profemur with basal third reddish with black spot medially; wings with anterior three-fourths dark brown and posterior fourth hyaline to very light amber (Fig. 546) . . . . *C. obtusa*
1′. Pronotum straight in lateral view (Figs. 603, 604); profemur without basal third reddish or with black spot medially; wings with anterior half brown to amber and posterior fourth light amber to amber (Figs. 545, 547) 2

2(1′). Pronotum with distinct hump dorsomedially in lateral view (Fig. 604) . . . . *C. porosa*
2′. Pronotum without distinct hump dorsomedially in lateral view (Fig. 603), at most with slightly raised, flattened region . . . . *C. brunnea*

Climaciella brunnea (Say, 1824)
(Figs. 545, 558–560, 563–565, 603)

DIAGNOSIS. — *Climaciella brunnea* can be separated from other Costa Rican mantispines by the combination of the pronotum being straight in lateral view and the wings with the anterior half brown to amber and posterior fourth light amber to amber. *Climaciella brunnea* is a polychromatic species whose different color forms have been presumed to be mimics of various species of polistine wasps (Hymenoptera: Vespidae: Polistinae). Opler (1981) described the five color forms occurring in Costa Rica and listed the possible wasp models.

GEOGRAPHICAL DISTRIBUTION. — This species occurs from southern Canada south to Costa Rica. Within Costa Rica specific localities are as follows: CARTAGO: Turrialba; GUANACASTE: Comelco Ranch, 8 km NW Bagaces; Hacienda La Pacifica, 4 km NW Cañas; Hacienda La Pacifica, 5 km N Cañas; La Pacifica, nr. Cañas; Taboga, 9.7 km S, 9.7 km W Cañas, 10°19′N, 85°09′W; 14 km S Cañas; Headquarters of Parque Nacional Santa Rosa, NW of Liberia; SAN JOSÉ: 10 km N San José.

ALTITUDINAL DISTRIBUTION. — 300–900 m.

ADULT FLIGHT PERIOD. — Every month except March.

HABITAT PREFERENCE. — Unknown.

Climaciella obtusa Hoffman, new species
(Figs. 546, 561, 566, 605)

(non) *Euclimacia semihyalina* (Lepeletier and Audinet-Serville), Navás 1927 (in part): 39 (Costa Rica: Cartago).
(non) *Climaciella semihyalina* (Lepeletier and Audinet-Serville), Hughes-Schrader 1969:110, 122 (female karyotype, Panama: Canal Zone), fig. 45 (female chromosomes), table 3 (chromosome numbers).

DIAGNOSIS. — Separated from other Costa Rican mantispines by the combination of the pronotum being distinctly bent ventrad at mid-length in lateral view and the wings with the anterior three-fourths dark brown.

MALE COLORATION. — Head black (Fig. 566), posterior margin of eyes and vertex yellow; mouthparts dark reddish brown, mandible reddish brown distally, lacinia and galea yellow-brown to reddish brown, palps dark reddish brown with apex yellow-brown; antenna with scape brown, pedicel and flagellum dark reddish brown; eyes metallic silver to light purple. Prothorax with pronotum and membranes black, pronotum very dark reddish brown ventrally; pleural sclerites and membranes very dark reddish brown, appearing blackish, sternum reddish brown; leg with coxa very dark reddish brown, distal fifth orange-red, sulcus sometimes yellow, trochanter reddish brown, femur orange-red proximad of major spine with black spots medially on each side, major spine dark reddish brown, remainder black, tibia very dark reddish brown, tarsus with tarsomere I dark reddish brown, tarsomeres II-V orange. Pterothorax black, metathoracic posterodorsal lobes margined with yellow posteriorly;

legs each with coxa very dark reddish brown, nearly black, trochanter and femur very dark reddish brown, tibia and tarsus dark reddish brown; forewing with membrane mostly dark amber (Fig. 546), posterior 0.2–0.3 hyaline, pterostigma and asperous region of 1AP brown, veins dark brown; hind wing similar to forewing. Abdomen black, pleura I-II yellow medially, tergite and sternite II usually with posterior margins narrowly yellow.

FEMALE COLORATION. — Same as for males.

THORAX. — Pronotum 2.2–2.5 times as long as wide at maculae in dorsal view (Fig. 561); pterothoracic scutella with combined 4–8 pores on each side, pretarsal claws with 5–6 teeth each; males with both wings collectively on each side with combined 14–17 veins leaving RP posteriorly, females with 17–18 veins; forewing lengths of males 15.8–24.0 mm, of females 17.0–24.2 mm.

MALE PREGENITAL ABDOMINAL APPARATUS. — Tergites IV-V each with paired patches of 18–36 small circular pores total in two transverse rows on each side anterolaterally, rows converging near midline on each side, pores with small conical collars internally, tergites V-VI with intersegmental membrane expanded into very slightly bilobed pocket extending anteriorly one-third length of tergite V, tergite V 1.5 times as long as VI.

MALE TERMINALIA. — Ectoprocts each ovoid in dorsal view, apex rounded, ventromedial lobe flattened dorsoventrally, lightly sclerotized ventrally, abruptly truncate along inner margin, with 50–65 short thickened setae dorsally and posteriorly; sternite IX pentagonal in ventral view, scooplike in lateral view, deepest near anterior margin, posterior margin produced into short, posteroventrally-directed, rounded lobe medially; gonarcus with medial third obliquely flattened anteroposteriorly, flattened region convex in lateral view and transversely ovoid in posterior view, median lobe spinelike, curved anteriorly, 2–3 times as long as wide at base; gonocoxites each as wide distally as basally in lateral view, distal fourth slightly bent dorsolaterally, apex narrowly rounded; mediuncus with anterior fourth slightly higher than remainder in lateral view, ventral surface laterally expanded into circular to oval plate extending 0.2–0.5 length of mediuncus, apex forked in posterior view; pseudopenal membrane broadly triangular, lightly sclerotized; hypomeres present as paired, small, granulate, circular to elliptical sclerites; pseudopenis sclerotized, spinelike in posterior view, slightly longer than pseudopenal membrane, flattened anteroposteriorly, apex broadly rounded to truncate, one-half or more as wide as base.

FEMALE TERMINALIA. — Ectoprocts as long to slightly longer than gonocoxites; sternite VIII 1.5 times as long medially as laterally, most of medial 0.2–0.3 separated posteriorly from sternite by narrow membranous region, medial section transversely elliptical with posterior margin slightly concave, posterior margin of remainder of sternite truncate; bursa lightly sclerotized; spermatheca with proximal, medial, and distal sections equal in width, diverticulae present as low transverse ridge, proximal section with first bend nestled within first spiral of medial section, medial section spiralling anteriorly for 1.5 loops before abruptly bending posteriorly, distal section spiralling posteriorly for 1.0–1.5 loops and intertwining with medial section, fertilization canal duct curved, fertilization canal truncate basad of apex.

GEOGRAPHICAL DISTRIBUTION. — Costa Rica (CARTAGO); Panama (Canal Zone); Colombia (Magdalena); and Ecuador (Los Ríos, Pichincha).

ALTITUDINAL DISTRIBUTION. — Elevation 900 m within Costa Rica.

ADULT FLIGHT PERIOD. — No information available for Costa Rica. Elsewhere during March, May, June, August, and October.

ETYMOLOGY. — Name is derived from the Latin adjective *obtusa*, meaning blunt or dull, and is in reference to the abruptly blunted apex of the male pseudopenis.

TYPE MATERIAL. — *Climaciella obtusa* holotype male (Florida State Collection of Arthropods, Gainesville [FSCA]), six paratype males, eight paratype females, and two paratypes of undetermined gender (American Museum of Natural History, New York [AMNH], Carnegie Museum of Natural History, Pittsburgh, PA [CMNH], FSCA, Deutsches Entomologisches Institut, Eberswalde-Finow, Germany [DEIC], Museum of Comparative Zoology, Harvard University, Cambridge, MA [MCZC], Museu de Zoologia, Universidade de São Paulo, Brazil [MZSP}, San Diego Natural History Museum [SDMC], University of Minnesota Insect Collection [UMIM], US National Museum of Natural History, Washington [USNM]). Holotype label data: "RÍO PALENQUE, ECUADOR/ LOS RIOS PROV. – C. DODSON / 197," "503," "HOLOTYPE MALE / Climaciella / obtusa Hoffman / det: K. M. Hoffman 1992." Condition of holotype: color excellent, wings unspread, forewing length 20.0 mm. Paratypes have the following label data associated with them: COSTA RICA: Cartago Prov., Cartago, N. Banks, 1 undet. (MCZC); Cartago Prov., Turrialba, Heyne, Berlin-Wilm., 1 male (DEIC); same data except 900 m, IV, 1 male (DEIC): Cartago Prov., Turrialba, 4., E. A. Böttcher, Berlin C. 2, 1 female (DEIC); PANAMA: Canal Zone, Barro Colorado Island, 1–9-V-1964, W. D. and S. S. Duckworth, 1 female (USNM); same locality, XI-1965, 399, Dr. Britsky, 1 female (MZSP); same locality, 6-X-1956, Ch. Gregoire, a 1538, 1 female (USNM); same locality, 19-III-1936, Gertsch, Lutz and Wood, 1 male (AMNH); Canal Zone, 9 km NW Gamboa, 10–12-VIII-1975, E. M. and J. L. Fisher, 1 female (SDMC); COLOMBIA: Magdalena Div., Bonda, (77 m), June, H. H. Smith, Carn. Mus. Acc. 1999, 1 undet. (MCZC); Magdalena Div., Don Diego (31 m), May, H. H. Smith, Carn. Mus. Acc. 1999, 1 female (CMNH); ECUADOR: Los Ríos Prov., Río Palenque, 197, C. Dodson 503, 1 male, 1 female (FSCA); same locality, 12-VI-1974, J. Longino 503, 1 male (FSCA); same locality, 12-VIII-1975, J. Longino, 1 female (FSCA); Pichincha Prov., Hotel Tinalandia, 12 km E Santo Domingo de los Colorados, 23-V-1985, Clausen and Cervenka, 1 male (UMIM).

***Climaciella porosa* Hoffman, new species**
(Figs. 547, 562, 567, 604)

Diagnosis. — *Climaciella porosa* can be separated from other Costa Rican mantispines by the combination of the pronotum bearing a distinct hump dorsomedially in lateral view and by the wings having the anterior half brown to amber.

Male Coloration. — Head with vertex and frons dark brown (Fig. 567), remainder yellow-brown, labrum with dark brown spot proximomedially; mandibles dark brown with yellow-brown proximomedially, other mouthparts yellow-brown, palps brown with distal segment yellow; antenna with scape yellow-brown with brown posterodistally, pedicel dark brown, flagellum with basal half light brown anteriorly, remainder light red with several apical flagellomeres pale yellow; eyes metallic purple. Prothorax with pronotum dark brown anterior of maculae, remainder brown dorsally, yellow-brown laterally and ventrally, posterior half with paired thin dark brown sinuous stripes laterally, posterodorsal membrane dark brown, posteroventral membrane pale yellow; pleural sclerites and membrane dark brown, sternum brown; leg with coxa brown, trochanter yellow-brown, femur dark reddish brown anterolaterally, reddish brown posterolaterally, yellow-brown proximad of major spine ventrally, tibia dark brown anterolaterally and distally, remainder and tarsus yellow to yellow-brown. Pterothorax with nota dark brown, pleura reddish brown, anterior membrane yellow-brown; legs each with coxa reddish brown, trochanter reddish brown, femur light brown to brown, tibia yellow-brown to light brown with apex brown, tarsus yellow-brown; forewing with anterior half amber (Fig. 547), posterior margin light amber, remainder hyaline, pterostigma and asperous region of 1AP brown, veins brown; hind wing similar to forewing. Abdomen dark brown, pleura I-II pale yellow.

Female Coloration. — Same as for male, except for the following: head with vertex, frons, clypeus, and labrum very dark brown, remainder brown; mandibles very dark reddish brown, other mouthparts dark brown; antenna with scape and pedicel dark brown, flagellum very dark brown with several apical flagellomeres brown; pronotum darker than that of male; proleg with coxa dark brown, femur dark reddish brown, spines reddish brown distally, tibia dark brown, tarsus with tarsomere I brown; pterothoracic legs each with trochanter yellow-brown proximally, brown distally, femur and tibia brown; abdomen yellow-brown to brown.

THORAX. — Pronotum 3.3–3.7 times as long as wide at maculae in dorsal view (Fig. 562), distinct hump dorsomedially (Fig. 604); pterothoracic scutella with combined 3–4 pores on each side, pretarsal claws with five teeth each; male with both wings collectively on each side with combined 14–15 veins leaving RP posteriorly, female with 16 veins; forewing length of male 12.7 mm, of female 14.7 mm.

MALE PREGENITAL ABDOMINAL APPARATUS. — Tergites IV-V each with paired patches of 137–160 small circular pores total in 10–12 transverse rows occupying entire tergite on each side laterally, rows continuous across midline, pores each surrounded by dark microtrichia externally and with small conical collars internally, tergites V-VI with intersegmental membrane not noticeably expanded into pocket, tergite V 1.25 times as long as VI.

MALE TERMINALIA. — Ectoprocts each ovoid to crescent-shaped in dorsal view, lobelike posterior to ventromedial lobe and as long as wide, apex rounded, ventromedial lobe flattened dorsoventrally, lightly sclerotized ventrally, abruptly truncate along inner margin, with 60–70 short thickened setae dorsally and posteriorly; tergite IX with ventral third with posterior margin concave; sternite IX triangular in ventral view, shallowly scooplike in lateral view, deepest near middle, posterior margin produced into short, posteroventrally-directed, rounded lobe medially; gonarcus with medial third obliquely flattened anteroposteriorly, flattened region convex in lateral view and transversely ovoid in posterior view, median lobe spinelike, curved anteriorly, twice as long as wide at base; gonocoxites each as wide distally as basally in lateral view, distal fourth bent dorsolaterally, apex narrowly rounded, separate flattened extension at three-fourths length directed medially up onto gonarcal membrane for short distance, as long as distal fourth of gonocoxite, apex pointed; mediuncus as high anteriorly as posteriorly in lateral view, ventral surface laterally expanded into small circular plate extending 0.2–0.4 length of mediuncus, apex truncate in posterior view; pseudopenal membrane broadly triangular, lightly sclerotized; hypomeres present as paired linear longitudinal series of 8–10 very small granules; pseudopenis sclerotized, spinelike in posterior view, distinctly shorter than pseudopenal membrane, flattened anteroposteriorly.

FEMALE TERMINALIA. — Ectoprocts as long as gonocoxites; sternite VIII 1.5 times as long medially as laterally, most of medial fifth separated posteriorly from sternite by narrow membranous region, medial section transversely elliptical with posterior margin slightly concave, posterior margin of remainder of sternite truncate; bursa lightly sclerotized; spermatheca with proximal, medial, and distal sections equal in width, diverticulae absent, area at diverticulae slightly concave with small flanges laterally, proximal section with first bend nestled within first spiral of medial section, medial section spiralling anteriorly for one loop before abruptly bending posteriorly, distal section bending anteriorly and then posteriorly, and curving along the right side of medial section, fertilization canal duct slightly curved basally, slightly twisted medially, fertilization canal sloping basad of apex.

GEOGRAPHICAL DISTRIBUTION. — Costa Rica (HEREDIA).

ALTITUDINAL DISTRIBUTION. — 50 m.

ADULT FLIGHT PERIOD. — May and June.

ETYMOLOGY. — Name is derived from the Latin adjective *porosa*, meaning full of pores, and is in reference to the pores of males, which occupy the full length of abdominal tergites IV and V in males.

TYPE MATERIAL. — Holotype male (Henry A. Hespenheide Collection [CHAH]) and paratype female (Clemson University Arthropod Collection [CUAC]). Holotype label data: "COSTA RICA: Heredia / Pr: La Selva Biol. Sta. / 3 km S Pt. Viejo / 10°26'N, 84°01'W," "19.v.1990 / H. A. Hespenheide," "HOLOTYPE male / Climaciella porosa / Hoffman / det: K. M. Hoffman 1992." Condition of holotype: color good, right antennal flagellum absent; right wings spread, forewing length 12.7 mm; abdomen detached, cleared, in glycerin-filled microvial attached to pin beneath labels. Label data associated with paratype: COSTA RICA: Heredía Prov., Est. Biol. La Selva, Quebrada Sura, 10.437°N, 84.010°W, el. 50 m, 20–21-VI-1986, Holzenthal, Heyn, Armitage, 1 female (CUAC).

Dicromantispa Hoffman, new genus

TYPE SPECIES. — *Mantispa sayi* Banks (1897) by present designation.

DESCRIPTION. — Head with shortest distance between eyes narrower than width of one eye at ventral margin of antennal sockets in frontal view, antennal flagellum at mid-length with flagellomeres 1–2 times as wide as long in anterior view. Pronotum straight in lateral view (Fig. 607), 3.3–7.3 times as long as wide at maculae in dorsal view, dorsal surface mostly glabrous, with some scattered fine setae, setal bases not elevated. Pterothorax with mesoscutal furrow prominent, pterothoracic scutella with 0–7 pores total on each side; legs each with tarsomere I nearly as long as or longer than tarsomeres II-V combined, pretarsal claws with 3–7 teeth each; both wings collectively on each side with combined 8–32 veins leaving RP posteriorly, forewing length 7.0–28.9 mm, pterostigma with sc-ra at 0.5–0.8 length of 3RA (Fig. 571), Sc distal to sc-ra at 40–60° angle to RA, 3RA with one c-ra crossvein distal to SC, AA and AP_1 simple, 1AP with posterior 0.3–0.5 asperous; hind wing with CuA strongly angled toward AA, cu-aa crossvein either very short or absent with CuA briefly fused with AA. Male abdomen with tergites IV-VI each with paired patches of 2–17 circular pores total in two transverse rows on each side anterolaterally, pores recessed in shallow circular to elliptical pits, tergite V 1.3 times as long as VI. Male terminalia with each ectoproct roughly ovoid in dorsal view and rounded distal to ventromedial lobe, ventromedial lobe strongly sclerotized and deeply cleft to form dorsal plate and finger-like ventral lobe, dorsal plate with 2–40 short thickened setae on dorsal margin, ventral lobe with 3–15 short, thickened setae at apex anteriorly; sternite IX semicircular to trapezoidal in ventral view; gonarcus with paired, anteriorly-projected apodemes sometimes present dorsolaterally, median lobe absent or small, anteroposteriorly flattened, and scale-like; gonarcal membrane unmodified or with small spinules medially; each gonocoxite lightly sclerotized, variously widened distally, apex rounded; mediuncus with anterior third 1.5–3.0 times as high as remainder in lateral view, anterior third sometimes excavated ventrally, apex forked; pseudopenal base membranous; hypomeres granular to elongate; pseudopenis sclerotized, spinelike; hypandrium internum triangular in ventral view, shallow and nearly straight in lateral view. Female terminalia with ectoprocts as long as, or longer than, gonocoxites; sternite VIII entire, transverse sclerotized ridge usually present immediately dorsal of and partially hidden by sternite VIII; bursa with entrance membranous to lightly sclerotized, remainder membranous to lightly sclerotized; spermatheca with proximal and medial sections nearly equal in width, distal section wider than medial section, diverticulae present as transverse ridge with paired small bumps or as medially-directed lobe, medial portion with 0.5–3.5 coils, fertilization canal duct bent at 0.3–0.5 length, fertilization canal slightly curved to C-shaped, sloped or truncate basad of apex.

CHROMOSOME COMPLEMENT. — Diploid chromosomal complement of 22 consisting of 20 autosomes and 2 sex chromosomes, based on *D. sayi*. Sex chromosomes of males are XY and those of females are XX.

IMMATURE STAGES. — Immature stages of *D. sayi* have been described (Hoffman and Brushwein 1992). The stalked eggs are oval with a caplike micropyle and are typical for mantispines. First instars are diagnosed as follows: head capsule brown, thoracic terga with paired brown rectangular to triangular markings, abdominal terga I-VIII white anteriorly, brown posteriorly, IX-X brown; mandibles untoothed, antennal scape cylindrical, longer than wide; legs with tarsus wider than long, unguitractor process up to half width of tarsus and as long as tarsal claw; abdominal segments I-VI with setae D4, SD3, and L2 at most barely reaching posterior margins of segments. Second and third instars are diagnosed as follows: legs with tarsus subquadrate, claw present; second instar with abdominal segment X shorter than IX, third instar with spigot less than twice as long as base. Pupae are diagnosed as follows: abdominal tergite IV with setae very short and not reaching above dorsal hooks, VIII with setae in two transverse rows laterally.

BIOLOGY. — Adults have been captured at lights and on vegetation. Immatures of *D. sayi* have been associated with 46 species of primarily hunting spiders in 14 families (Hoffman and Brushwein 1992), and *D. gracilis* has been reared from egg sacs of *Trechalea manausensis* Carico (Araneae: Pisauridae) (Carico et al. 1985). The vast majority of recorded spider hosts for members of this genus are wandering hunting spiders. First instars of *D. sayi* board spiders and are known to be facultative boarder/penetrators.

GEOGRAPHICAL DISTRIBUTION. — Southern Canada south to Argentina, including the Bahama Islands, Cuba, and Puerto Rico.

ETYMOLOGY. — A combination of the Greek adjective *dicro*, meaning forked, and *mantispa* as coined by Illiger (1798), which is a combination of the Greek noun *mantis*, meaning soothsayer or prophet, and the suffix *pa*, which is derived either from the Greek *para*, meaning near or beside, or the Latin *par*, meaning equal. The name is in reference to the deeply cleft, ventromedial lobes on the male ectoprocts. Gender is feminine.

DISCUSSION. — This genus contains eight species, four of which have been collected in Costa Rica. Members of this genus can be distinguished by the combination of the head being mostly brown above antennae, the presence of only a few scattered setae on the pronotum in lateral view with most setae at the anterior and posterior ends, paired longitudinal yellow stripes on the mesonotum laterally, and the mesonotum anterior to the mesoscutal furrow being brown. Of the Costa Rican species, immatures of *D. sayi* (Banks) have been associated with 46 species of spiders in 14 families, and *D. gracilis* (Erichson) has been reared from egg sacs of *Trechalea amazonica* F. O. Pickard-Cambridge (Trechaleidae). All larval instars and pupae of *D. sayi* have been described.

KEY TO COSTA RICAN *DICROMANTISPA*

1. Forewing with Sc yellow to yellow-brown throughout its length, distinctly lighter than costal crossveins; cell 1M hyaline . . . . *D. gracilis*
1′. Forewing with Sc brown basally, at least on basal half, essentially same color as costal crossveins; cell 1M mostly amber or at least radial triangle and Sc space amber (Fig. 571) 2

2(1′). Antennae tricolored, with basal 2/3 brown, next 1/6 yellow, and apical 1/6 dark brown . . . . *D. sayi*
2′. Antennae entirely dark brown 3

3(2′). Head above antennae with yellow marks forming a broad, procurved band (Fig. 583); pterothorax with anterior membrane yellow dorsally . . . . *D. synapsis*
3′. Head above antennae with yellow marks narrow, not forming a broad band across head (Fig. 580); pterothorax with anterior membrane brown dorsally . . . . *D. debilis*

Dicromantispa debilis (Gerstaecker, 1888) [new combination]
(Figs. 574, 580)

DIAGNOSIS. — Separated from other Costa Rican mantispines by the combination of a pronotum with only a few scattered setae in lateral view with most setae at the anterior and posterior ends, paired longitudinal yellow stripes on the mesonotum laterally, the forewing with Sc brown basally and essentially the same color as the costal crossveins, antennae entirely dark brown, the head above the antennae with thin, curved, yellow marks forming medially interrupted circle (Fig. 580), and the pterothorax with the anterior membrane brown dorsally.

GEOGRAPHICAL DISTRIBUTION. — Costa Rica south to Bolivia. Within Costa Rica it is only known from: HEREDIA: La Selva Biological Station, 3 km S Puerto Viejo, 10°26′N, 84°01′W.

ALTITUDINAL DISTRIBUTION. — Unknown.

Adult Flight Period. — June and July in Costa Rica.

Habitat Preference. — Unknown.

Dicromantispa gracilis (Erichson, 1839) [new combination]
(Figs. 572, 575, 581)

Diagnosis. — Separated from other Costa Rican mantispines by the combination of the pronotum with only a few scattered setae in lateral view with most setae at the anterior and posterior ends, paired longitudinal yellow stripes on the mesonotum laterally, and the forewing with Sc yellow to yellow-brown and distinctly lighter than costal crossveins.

Geographical Distribution. — Costa Rica south to Argentina. Within Costa Rica specific localities are as follows: GUANACASTE: 3 mi NW Cañas (La Pacifica), PUNTARENAS: Golfito; 4.5 km E Golfito; Río Palmare Ferry Crossing, nr. Brujo, Pan American Hwy.

Altitudinal Distribution. — 150 m.

Adult Flight Period. — July and September.

Habitat Preference. — Unknown.

Dicromantispa sayi (Banks, 1897) [new combination]
(Figs. 571, 576, 582, 607)

Diagnosis. — Separated from other Costa Rican mantispines by the combination of the pronotum with only a few scattered setae in lateral view with most setae at the anterior and posterior ends, paired longitudinal yellow stripes on the mesonotum laterally, the forewing with Sc brown basally and essentially the same color as the costal crossveins, head above the antennae with paired (sometimes fused), small, comma-shaped, yellow marks medially (Fig. 582), and the tricolored antennae, with the basal 2/3 brown, next 1/6 yellow, and apical 1/6 dark brown.

Geographical Distribution. — Most of the United States south to Panama, including the Bahama Islands, Cuba, and Puerto Rico. Within Costa Rica specific localities are as follows: GUANACASTE: Hacienda Tempisquito (Pelón de la Altura), 1 km NE of km 265, rt 1, 10.84°N, 85.56°W; Hacienda La Pacifica; La Pacifica, nr. Cañas; La Pacifica, 4 km NW Cañas; 14 km S Cañas; Parque Nacional Santa Rosa; PUNTARENAS: Golfito.

Altitudinal Distribution. — 100–300 m.

Adult Flight Period. — Every month except August and September.

Habitat Preference. — Unknown.

Dicromantispa synapsis Hoffman, new species
(Figs. 573, 577, 583)

Diagnosis. — Separated from other Costa Rican mantispines by the combination of the pronotum with only a few scattered setae in lateral view with most setae at the anterior and posterior ends, paired longitudinal yellow stripes on the mesonotum laterally, the forewing with Sc brown basally and essentially the same color as the costal crossveins, antennae entirely dark brown, the head above the antennae with yellow marks forming a broad, procurved band, and the pterostigma with the anterior membrane yellow dorsally.

Male Coloration. — Head yellow (Fig. 577), vertex mostly covered by inverted brown triangular mark, brown extending between antennal bases, slightly procurved transverse yellow stripe above antennae, ends of stripe obscuring lateral margins of brown region, sometimes a yellow stripe along the midline connecting with transverse stripe to form inverted Y-shaped mark, lateral margins sometimes indented at mid-length, a thin transverse brown stripe sometimes extending to ocular margins beneath antennal bases, anterior half of frons sometimes with brown triangular mark medially, brown stripe along midline from between antennae, from midfrons, or from clypeus and onto labrum; mandibles orange-brown, sometimes pale yellow distomedially, other mouthparts yellow with palps yellow-brown; antenna with scape yellow anteriorly, brown posteriorly, pedicel brown, flagellum dark brown; eyes metallic silver. Prothorax with pronotum yellow-brown to light brown, usually yellow ventrally, paired wide diffuse brown stripes from anterolateral corners to maculae (Fig. 583), maculae brown, paired wide diffuse brown stripes from mid-length to posterolateral margins, posterodorsal membrane entirely yellow to yellow-brown or yellow anteriorly, brown posteriorly, posteroventral membranes yellow; cervical sclerite brown dorsally, yellow ventrally, episternum, sternum, and membrane yellow; leg with coxa yellow with light brown distad of sulcus posteriorly, trochanter yellow-brown, femur yellow-brown anterolaterally with dark reddish brown medially from apex to base of major spine, yellow to yellow-brown posterolaterally with base of spine row dark orange-brown to brown, dorsal surface yellow-brown, spines orange-brown, tibia yellow with apex reddish brown anteriorly, tarsus with tarsomere I reddish brown, remainder yellow to yellow-brown. Pterothorax with nota brown to dark reddish brown, mesonotum with narrow longitudinal yellow stripes at one-third width on each side, stripes mostly obscure on metanotum, pleura yellow, mesopreepisternum, mesokatepisternum, and anterior margin of mesanepisternum brown sometimes, mesopreepisternum yellow with paired small diffuse reddish brown spots laterally sometimes; legs each with coxa yellow, mesocoxa sometimes brown, remainder of leg segments yellow to yellow-brown; forewing membrane hyaline (Fig. 573), Sc space basad of radial triangle, radial triangle, 1M, most of 1Cu and 1AA light brown, remainder of Sc space very light amber to opaque, pterostigma dark reddish brown to dark brown, sometimes with basal fourth yellow, 1AP with asperous region pale yellow, most veins brown, fused C+Sc sometimes Sc inside pterostigma, RA basad of sc-ra dorsally, proximal half of CuA dorsally, AA yellow except at apex, AP_1, AP_2, and wing margin basad of AA yellow; hind wing similar to forewing, Sc space entirely very light amber to opaque, 1A hyaline, pterostigma entirely dark reddish brown to dark brown, Sc basad of pterostigma yellow except at base, RA brown except along 2RA. Abdomen with tergites yellow with broad dark reddish brown stripe along midline, stripe widening posteriorly on each segment, ectoprocts dark brown; pleura I-II black, remainder yellow to dark reddish brown dorsally, dark brown ventrally and widening posteriorly on each segment; sternites yellow-brown or yellow with brown posteromedially, discolored.

Female Coloration. — Same as for males, except for the following: antennae sometimes with scape entirely brown; procoxa brown distad of sulcus posterolaterally and posteriorly; prothorax with pronotum entirely brown anterior of maculae dorsally; sometimes with cervical sclerite entirely yellow; procoxa sometimes light brown distad of sulcus laterally, profemur entirely dark reddish brown anterolaterally, posterior midline yellow proximad of spine row; pteropleura with margins of anterior membrane dark brown, mesopreepisternum, katepisterna, katepimera, and most of mesanepisternum dark brown, metanepisternum and anepimera sometimes brown posteriorly, coxae brown to dark brown or mesocoxa brown anteriorly and metacoxa brown anterolaterally, trochanter usually light brown medially; abdominal tergites very dark brown instead of dark reddish brown, pleura entirely dark brown to black, sternites yellow I-VI with posterior margins dark reddish brown, I-IV sometimes entirely yellow with VI dark brown, VII entirely dark brown, VIII light brown to brown, ectoprocts and gonocoxites dark reddish brown to yellow.

Male Pregenital Abdominal Apparatus. — Tergires II-V with medial sixth of posterior margins sclerotized and slightly concave, IV-VI each with paired patches of 3–8 circular pores total in two transverse rows on each side anterolaterally, pores with very small conical collars internally, pores recessed in shallow circular to elliptical pits, tergite V 1.3 times longer than VI.

Male Terminalia. — Ectoprocts each ovoid in dorsal view, apex rounded, ventromedial lobe entirely sclerotized, laterally-flattened, platelike, with thin dorsally-curved lobe from posteroventral corner, roughly triangular in lateral view, posterior margin longer than others, margins relatively straight, anteroventral corner broadly rounded, dorsal apex rounded with 2–5 short thickened setae, posteroventral lobe rounded laterally with 4–12 shorter thickened setae at apex anteriorly; sternite IX somewhat quadrate in ventral view, posterior margin slightly produced medially and rounded apically; gonarcus without median lobe, gonarcus produced anteriorly with paired short dorsoventrally-flattened lobes; gonarcal membrane with subquadrate patch of golden yellow, prostrate, anteriorly-directed spinules medially, posterior corners extended posteriorly into thin lobes; gonocoxites each sclerotized, distal half twice as wide as remainder, apex rounded, extended dorsally onto gonarcal membrane and joining with posterolateral lobes of spinule patch; mediuncus with anterior half ovoid in lateral view, 2–3 times as high as remainder, apex forked; pseudopenal membrane triangular in posterior view, lightly sclerotized; hypomeres teardrop-shaped, widest ventrally and irregularly granulate; pseudopenis sclerotized, spinelike in posterior view, longer than height of pseudopenal membrane, flattened laterally, bladelike in lateral view.

FEMALE TERMINALIA. — Ectoprocts longer than gonocoxites; sternite VIII as long medially as laterally, posterior margin broadly rounded to truncate medially, very slightly concave at midline, dorsal surface lightly sclerotized laterad of midline, membrane immediately posterior to dorsal surface lightly sclerotized, less so at midline, and collapsing against dorsal surface of sternite VIII to form pocket distinctly shorter than length of sternite; membrane between sternite VIII and bursa with transverse, rectangular, sclerotized patch of pointed to rounded microspines medially, patch four times as wide as long, three-fourth width of sternite VIII, distinctly convex; bursa lightly sclerotized to membranous; spermatheca with proximal and medial sections equal in width, distal section twice as wide as proximal, proximal section with first bend laterad of medial section, sinuous between first and second bends, diverticula present as low ridge or absent, medial section with two bends, fertilization canal duct darkened at base, sinuous, fertilization canal truncate basad of apex.

THORAX. — Pronotum 5.6–7.3 times as long as wide at maculae in dorsal view; pterothoracic scutella with combined 3–7 pores on each side, pretarsal claws with 5–6 teeth each, males with both wings collectively on each side with combined 13–15 veins leaving RP posteriorly, females with 11–16 veins, forewing lengths of males 9.3–13.7 mm, of females 9.8–15.8 mm.

GEOGRAPHICAL DISTRIBUTION. — Costa Rica (CARTAGO, LIMÓN); Panama (Bocas del Toro, Panama); French Guiana (Cayenne); Brazil (Rio de Janeiro, Santa Catarina).

ADULT FLIGHT PERIOD. — In Costa Rica March and May. They have been collected during February, May, June, and from October to December in other countries.

ALTITUDINAL DISTRIBUTION. — Elevation 60 m in Costa Rica.

ETYMOLOGY. — Name is derived from the Greek noun *synapsis*, meaning a connection, union, or junction, and is in reference to the unique articulation of the male gonocoxites dorsally with the patch of spinules on the gonarcal membrane.

TYPE MATERIAL. — Holotype male (Peabody Museum of Natural History, Yale University, New Haven, CT [PMNH]), three paratype males, ten paratype females, and one paratype of undetermined gender (AMNH, CMNH, CUAC, FSCA, LSUC, MCZC, PMNH, SDMC). Holotype label data: "Brasilien / Nova Teutonia / 27°11′B, 52°23′L / Fritz Plaumann / XII-1962 / 300–500 m" [date and altitude are written vertically, with date along right margin and altitude along left margin]. "HOLOTYPE male / Dicromantispa synapsis / Hoffman / Det. K. M. Hoffman 1991." Condition of holotype: color excellent, forewing length 13.8 mm, abdomen detached, cleared, in glycerin-filled microvial attached to pin beneath labels. Paratypes have the following label data. COSTA RICA: Cartago Prov., Turrialba-C.A.T.I.E., 28–31-V-1987, E. Giesbert, 1 female (FSCA); Limón Prov., Río Uatsi, 8 km (air) W. Bribri, 9.62°N, 89.90°W, el. 60 m, 25-III-1987, Holzenthal, Hamilton, Heyn, 3 females (CUAC); PANAMÁ: Bocas del Toro Prov., 10 km NE Fortuna Dam, 1–2-VI-1986, E. Giesbert, 1 female (FSCA); Panamá Prov., 10 km N El Llano, 16–22-V-1987, E. Giesbert, 1 male (FSCA); FRENCH GUIANA: Cayenne Dept., Hwy N2 to Regina, 67 km S of Cayenne, 4-VI-1986, E. G. Riley and D. A. Rider, 1 female (LSUC); BRAZIL: PARÁ: Oriximina, Rio Trombetas, ALCOA Miner., km 22, 28-XI-1982, N. Penny, 1 female (SDMC); SANTA CATARINA: Corupa (Hansa Humboldt), II-1946, A. Maller, Coll., Frank Johnson, Donor, 1 female (AMNH); Nova Teutonia, 27°11′B, 52°23′L, 300–500 m, X-1962, Fritz Plaumann, 1 female (PMNH); Nova Teutonia, 27°11′B, 52°23′L, 30-XI-1939, Fritz Plaumann, 1 male (MCZC); RIO DE JANEIRO: Rio de Janeiro, Dec., Acc. No. 2966, H. H. Smith, 1 female (CMNH); Rio de Janeiro, Dec., H. Smith, 1 undet. (MCZC); Rio, Nov., H. Smith, 1 male (MCZC).

Entanoneura Enderlein, 1910

This genus contains six species occurring from southern Mexico south to northern Argentina, one of which has been collected in Costa Rica. The immature stages are unknown.

Entanoneura batesella (Westwood, 1867) [new combination]

(Figs. 551, 556, 570, 602)

DIAGNOSIS. — Separated from other Costa Rican mantispines by the combination of transverse brown stripes above and beneath the antennae, the forewing usually with the basal third of cell 1RA amber, the mesonotum yellow anterior to the mesoscutal furrow and with paired yellow stripes angled from wing bases to the scutellum on the mesonotum.

GEOGRAPHICAL DISTRIBUTION. — Southern Mexico south to Brazil. Within Costa Rica specific localities are as follows: CARTAGO: Turrialba; 15 km NE of Turrialba; HEREDIA: La Selva Biological Station, 3 km S Puerto Viejo, 10°26′N, 84°01′W; La Selva Biological Station, nr. Puerto Viejo de Sarapiqui; 1 km S Pt. Vieja; LIMÓN: plain of Limón near Las Mercedes, Farm Hamburg at Reventazón.

ALTITUDINAL DISTRIBUTION. — Unknown.

ADULT FLIGHT PERIOD. — February, April, June, August, and December.

HABITAT PREFERENCE. — Unknown.

REMARKS. — *Entanoneura limbata* (Gerstaecker, 1885), which has been reported from Costa Rica, is a **new synonym** of *Entanoneura batesella.*

Haematomantispa Hoffman, new genus

TYPE SPECIES. — *Mantispa nubeculosa* Navás, 1933 by present designation.

DESCRIPTION. — Head with shortest distance between eyes narrower than width of one eye at ventral margin of antennal sockets in frontal view, antennal flagellum at mid-length with flagellomeres 1.5 times as wide as long in anterior view. Pronotum straight in lateral view, 5.5–7.6 times as long as wide at maculae in dorsal view, dorsal surface with scattered fine setae, setal bases not elevated. Pterothorax with mesoscutal furrow prominent, scutella without pores; legs each with tarsomere I slightly shorter than tarsomeres II-V combined, pretarsal claws with 5–6 teeth; both wings collectively on each side with combined 12–16 veins leaving RP posteriorly, forewing length 8.8–15.0 mm, sc-ra at mid-length of 3RA, Sc distal to sc-ra at 50–60° angle to RA (Fig. 569), 3 RA with one c-ra crossvein distal to Sc, AA and AP_1 simple, 1AP with posterior third asperous; hind wing with CuA strongly angled towards AA and fused for a variable distance. Male abdomen with tergites III-V lacking pores, intersegmental membrane between tergites V-VI invaginated into single-lobed pocket extending anteriorly 0.2–0.4 length of tergite V, tergite V twice as long as tergite VI. Male terminalia with each ectoproct somewhat oval in dorsal view, rounded distally, ventromedial lobe very lightly sclerotized, directed medially, constricted dorsoproximally, flattened apically, with 50–70 short thickened setae over entire surface; sternite IX semicircular to trapezoidal in ventral view, posterior margin lobed medially with apex rounded; gonarcus with broad, triangular, anteroposteriorly-flattened lobe medially or with toothlike median lobe, gonarcus with anterior margin produced dorsally behind lobe into anteroposteriorly-flattened flange either medially or at dorsolateral corners; gonarcal membrane without spinules; gonocoxites each wider distally than basally in lateral view, distal half convex, abruptly narrowed to point apically; mediuncus notched anteroventrally in lateral view, nearly uniform height throughout, apex forked in posterior view; pseudopenal membrane lightly granulate; hypomeres present as paired small, darkened, circular sclerites or absent; pseudopenis sclerotized, setalike, apex curved anteriorly; hypandrium internum triangular in ventral view, shallow and with posterior point slightly curved dorsad in lateral view. Female terminalia with ectoprocts shorter or longer than gonocoxites; sternite VIII entire, longer medially than laterally; bursa with entrance lightly sclerotized, remainder lightly sclerotized to membranous; spermatheca with proximal section as wide as most of medial section, medial section gradually widened after first bend, distal section 2–3 times as wide as proximal section, proximal section sinuous between bends, diverticulae present as one very small bump or as paired small bumps, medial section with two bends or 1.5 coils, fertilization canal duct sinuous, fertilization canal truncate basad of apex.

Chromosome Complement. — Unknown.

Immature Stages. — Unknown.

Biology. — Adults have been captured at lights.

Geographical Distribution. — Costa Rica and Panama.

Etymology. — A combination of the Greek adjective *haemato*, meaning blood red, and *mantispa* as coined by Illiger (1798), which is a combination of the Greek noun *mantis*, meaning soothsayer or prophet, and the suffix *pa*, which is derived either from the Greek *para*, meaning near or beside, or the Latin *par*, meaning equal. The name is in reference to the striking red coloration of the included species. Gender is feminine.

Haematomantispa nubeculosa **(Navás, 1933) [new combination]**

(Figs. 569, 578, 584)

Diagnosis. — Separated most easily from other Costa Rican mantispines by the combination of an amber infuscation posterior to cell 1MP in the forewing and the mostly dark red body coloration.

Geographical Distribution. — This species occurs in Costa Rica and Panama. Within Costa Rica specific localities are as follows: ALAJUELA: Reserva Forestal San Ramón, Río Lorencito and tribs., 10.216°N, 84.607°W; CARTAGO: Turrialba; near Turrialba; HEREDIA: La Selva Biological Station, 3 km S Puerto Viejo, 10°26′N, 81°01′W; Puerto Viejo de Sarapiqui; LIMÓN: Reserva Biol. Hitoy-Cerere, Río Cerere, 9.671°N, 83.028°W; Río Banano, 16 km WSW Bomba, 9.888°N, 83.167°W; Río Uatsi, 8 km (air) W Bribri, 9.62°N, 82.90°W; near Rita (Hamburg, at Reventazón); locality not found: Paso Marcos; Pta. Uvita.

Altitudinal Distribution. — 40–1000 m.

Adult Flight Period. — January to August, and November.

Habitat Preference. — Unknown.

Leptomantispa **Hoffman, new genus**

Type Species. — *Mantispilla pulchella* Banks, 1912 by present designation.

Description. — Head with shortest distance between eyes narrower than width of one eye at ventral margin of antennal sockets in frontal view, antennal flagellum at mid-length with flagellomeres 1.2–2.0 times as wide as long in anterior view. Pronotum straight in lateral view, 5.5–7.4 times as long as wide at maculae in dorsal view, dorsal surface with numerous fine setae (Fig. 608), setal bases not elevated. Pterothorax with mesoscutal sulcus prominent, pterothoracic scutella with combined 2–6 pores on each side; legs each with tarsomere I longer than tarsomeres II-V combined, pretarsal claws with 3–5 teeth each; both wings collectively on each side with combined 6–14 veins leaving RP posteriorly, forewing length 5.2–14.5 mm, pterostigma with sc-ra at less than mid-length of 3RA, Sc distal to sc-ra at 40–50° angle to RA (Fig. 586), 3RA with one c-ra crossvein distal to Sc, AA and AP_1 simple, 1AP asperous along AP_2; hind wing with CuA strongly angled toward AA and fused with AA for varied distance, 2cu-m sometimes absent, CuA sometimes with 3cu-m absent and with terminal branch fused with MP, AA often fused with wing margin prior to fusion with CuA. Male abdomen with tergites III-IV each with or without pores along posterior margin, 1–17 pores on each side of tergite when present, tergites IV-V each with pores anterolaterally, 6–40 pores on each side of tergite, tergite V 1.7–3.0 times as long as VI, intersegmental membrane between tergites V-VI usually invaginated into single-lobed pocket extending anteriorly 0.2–0.4 length of tergite V. Male terminalia with each ectoprct ovoid to crescent-shaped in dorsal view, apex rounded, sclerotized ventrad of ventromedial lobe, ventromedial lobe sometimes somewhat flattened dorsoventrally, abruptly truncate along inner margin, with 8–35 short thickened setae; tergite IX sometimes with ventral fourth concave anteriorly; sternite IX pentagonal to triangular in ventral view, posterior margin rounded medially; gonarcus with median lobe spinelike to lobelike, slightly curved anteriorly, 1–4 times as long as wide at mid-length; each gonocoxite up to three times as wide distally as basally in lateral view, apex rounded or pointed; mediuncus with anterior 0.2–0.4 up to three times as high as remainder in lateral view, apex forked in posterior view; pseudopenal membrane broadly ovoid to rectangular in posterior view, with dorsally-projecting microspines or granules laterally and often medially; hypomeres present as paired small circular sclerites or granules; pseudopenis sclerotized; spinelike in posterior view, less than twice as long as pseudopenal membrane; hypandrium internum triangular in ventral view, shallow and nearly straight in lateral view. Female terminalia with ectoprocts shorter or longer than gonocoxites; sternite VIII 1–2 times as long medially as laterally; bursa with entrance lightly sclerotized, remainder membranous to lightly sclerotized; spermatheca with proximal section as wide as, or wider than, medial section, distal section wider than proximal, diverticula present as thin transverse rod or as medially-directed lobe from inner margin, proximal section with first bend right laterad of medial section, medial section twisting anteriorly for 2–4 bends, distal section C-shaped in ventral view, fertilization canal duct curved to sinuous, fertilization canal sloping basad of apex.

CHROMOSOME COMPLEMENT. — Diploid chromosome complement of 22 consisting of 20 autosomes and 2 sex chromosomes, based on *L. pulchella* (Hughes-Schrader, 1969). Sex chromosomes of males are XY and those of females are XX.

IMMATURE STAGES. — Larvae and pupae of *L. pulchella* have been described (Hoffman and Brushwein 1992). First instars are diagnosed as follows: head capsule pale white, tergites with bracketlike brown markings laterally; head with setae S1 and S4 surpassing lateral margin of head, mandibles with three teeth on inner margin medially, antennal scape cylindrical, slightly longer than wide; legs with tarsus wider than long, unguitractor process nearly as wide as tarsus and nearly twice as long as tarsal claw, empodium five times as wide distally as basally; abdominal segments I-VI with setae D4, SD3, and L2 distinctly surpassing posterior margins of segments. Second and third instars are diagnosed by the following: legs with tarsus peglike, claw absent; abdominal segment X shorter than IX, second instar with segment X broadly conical apically, third instar with spigot less than twice as long as base. Pupae are diagnosed by the following: abdominal tergites III-IV each with setae 2–3 times as long as height of dorsal hooks in lateral view, tergite VIII with setae in one transverse row laterally.

BIOLOGY. — Adults have been collected at lights and on foliage. Immatures of *L. pulchella* have been associated with 21 spider species in 8 families (Hoffman and Brushwein 1992), and are spider boarders.

ETYMOLOGY. — A combination of the Greek adjective *lepto*, meaning frail or scaled, and *mantispa* as coined by Illiger (1798), which is a combination of the Greek noun *mantis*, meaning soothsayer or prophet, and the suffix *pa*, which is derived either from the Greek *para*, meaning near or beside, or the Latin *par*, meaning equal. The name refers both to the relatively small size and frail body construction and to the dorsally-projecting scalelike microspines on the male pseudopenal membrane. Gender is feminine.

REMARKS. — This genus contains eight species occurring from southwestern Canada south to northern Argentina, including islands of the Greater and Lesser Antilles. Two species are known from Costa Rica, and a third has a distribution which brackets the country and is therefore included in the summary below. Members of this genus can be distinguished by the combination of prominent setae over the entire length of the pronotum in lateral view with most setae arising flush with the pronotal surface, the forewing lacking an amber infuscation posterior to cell 1MP, and with Sc distal to sc-ra at a 40–50° angle to RA in the forewing. The immatures of *Leptomantispa pulchella* (Banks), which occurs in Costa Rica, have been associated with 21 species of spiders in 8 families, and all three larval instars and the pupa have been described.

KEY TO COSTA RICAN *LEPTOMANTISPA*

1. Mesoscutellum brown medially, yellow laterally (Fig. 585); mesofemur with longitudinal brown stripe ventrally; forewing with subcostal space hyaline, pterostigma light red . . . . *L. pulchella*
1′. Mesoscutellum entirely yellow (Figs. 597, 598); mesofemur without longitudinal brown stripe ventrally; forewing with subcostal space distinctly amber, pterostigma reddish brown to dark brown 2

2(1′). Pronotum entirely dark reddish brown to dark brown (Fig. 597); forewing with pterostigma dark brown . . *L. chaos*
2′. Pronotum yellow-brown to brown dorsally (Fig. 598); forewing with pterostigma reddish brown to brown *L. nymphe*

***Leptomantispa chaos* Hoffman, new species**
(Figs. 587, 592, 597)

DIAGNOSIS. — Separated from other Costa Rican mantispines by the combination of prominent setae over the entire length of the pronotum in lateral view with most setae arising flush with the pronotal surface, pronotum entirely dark reddish brown to dark brown, mesoscutellum entirely yellow, forewing with subcostal space distinctly amber and the pterostigma dark brown.

MALE COLORATION. — Head yellow, vertex brown except along ocular margins, paired short transverse yellow stripes somewhat posteriad of antennae and usually not meeting at midline, narrow elliptical yellow spot above and between antennae, brown stripe along midline from slightly anteriad of antennae and onto labrum, stripe often forked at antennae with ends curling around antennal bases posteriorly, widened beneath antennae to form transverse brown stripe, clypeus usually with distal margin brown; mandibles yellow basally, reddish brown distally, other mouthparts yellow, stipes, prementum, and ligula yellow-brown to brown, palps light brown; antenna with scape yellow anteriorly, reddish brown posteriorly, pedicel reddish brown, flagellum dark brown; eyes metallic purple. Prothorax with pronotum dark reddish brown to brown, posterodorsal membrane dark brown, posteroventral membrane yellow with dark brown laterally; pleural sclerites and sternum brown, membrane pale yellow; leg with coxa dull yellow, apex brown, trochanter yellow-brown, femur pale yellow at base, ventral midline yellow basad of major spine, dark reddish brown anterolaterally, reddish brown posterolaterally, base of spine row pale yellow, tibia reddish brown, yellow-brown posterolaterally, tarsus reddish brown. Pterothorax with nota brown, scutella yellow, yellow spot at each wing base; pleura yellow, mottled with dark brown especially anteriorly on pleural sclerites, anterior membrane pale yellow with dark brown Y-shaped mark medially, sometimes variously spotted with brown; legs each with coxa yellow, mottled with brown, trochanter brown, femur yellow-brown, base brown, tibia and tarsus yellow-brown; forewing membrane hyaline, Sc space amber, pterostigma dark brown, 1AP with asperous region yellow-brown, most veins dark brown, AP_1 yellow basally; hind wing similar to forewing, AA yellow except at apex. Abdomen with tergites dark brown, tergites I-V with posterolateral corners yellow; pleura dark brown, spiracles and dorsal and ventral margins yellow; sternites dark reddish brown to dark brown, paired oval yellow spots sublaterally, sternites VI-IX with spots extending length of sternites.

FEMALE COLORATION. — Same as for males, except for the following: pterothorax with pleura nearly entirely brown; abdomen with tergites entirely dark reddish brown, pleura with only ventral margin yellow, sternites dark reddish brown with paired small yellow spots sublaterally on III-VII.

THORAX. — Pronotum 6.4–7.4 times as long as wide at maculae in dorsal view; pterothoracic scutella with combined 2–4 pores on each side, pretarsal claws with four teeth each, males and females with both wings collectively on each side with combined 6–8 veins leaving RP posteriorly, forewing lengths of males and females 6.8–9.5 mm.

MALE PREGENITAL ABDOMINAL APPARATUS. — Tergites III-IV each with paired patches of 3–17 small circular closely-packed pores total in one transverse row on posterior margin on each side, IV-V each with paired patches of 14–40 small circular pores total closely packed into inverted U-shaped band on each side anterolaterally, posterior arm of U-shaped band shorter than anterior arm on tergite V and nearly absent on IV, tergites V-VI with intersegmental membrane invaginated into single-lobed pocket extending anteriorly two-fifths length of tergite V, tergite V three times as long as VI.

MALE TERMINALIA. — Ectoprocts each ovoid to crescent-shaped in dorsal view, apex rounded, sclerotized ventrad of ventromedial lobe, ventromedial lobe sclerotized, flattened posteriorly, abruptly truncate along inner margin, with 12–22 short thickened setae dorsally and posteriorly; sternite IX pentagonal in ventral view, posterior margin broadly rounded medially; gonarcus with median lobe projecting from posterior surface, flattened posteriorly and projecting slightly posteriad from gonarcus before curving dorsally, slightly curved anteriorly, lobelike in posterior view, 2–3 times as long as wide, apex rounded; gonocoxites each twice as wide distally as basally in lateral view, apex narrowed and rounded; mediuncus with anterior third ovoid to semicircular in lateral view, 2–3 times as high as remainder, apex forked in posterior view; pseudopenal membrane ovoid in posterior view, covered with golden yellow dorsally-projecting microspines; hypomeres present as paired small granules; pseudopenis sclerotized, spinelike in posterior view, slightly curved posteriorly, as long as pseudopenal membrane and longer than gonarcal median lobe.

FEMALE TERMINALIA. — Ectoprocts as long as gonocoxites; sternite VIII strongly curved posteriorly, slightly longer medially than laterally, medial fifth with posterior margin truncate to shallowly concave; bursa with entrance lightly sclerotized, remainder membranous to lightly sclerotized; spermatheca with proximal section as wide as medial section, distal section three times as wide as proximal, diverticulae present as thin transverse medially-directed lobe from inner margin of spermatheca, proximal section with first bend right laterad of medial section, medial section with 2–3 bends, fertilization canal duct sinuous to twisted, fertilization canal sloping basad of apex.

GEOGRAPHICAL DISTRIBUTION. — Guatemala (Alta Vera Paz); Panama (Canal Zone); Venezuela (Aragua); French Guiana (Saint Laurent du Maroni); Brazil (Pará). It has not been collected to date in Costa Rica, but its distribution brackets the country and it will most likely be collected in the future.

ALTITUDINAL DISTRIBUTION. — Unknown for Costa Rica.

ADULT FLIGHT PERIOD. — Unknown for Costa Rica. Adults have been captured in other countries during January, March, April, June, and July.

ETYMOLOGY. — Name derived from the Greek noun *chaos*, meaning utter confusion or disorder, and is in reference to the rather difficult time I had deciding whether the specimens assigned to this species were distinct from *L. pulchella*.

TYPE MATERIAL. — Holotype male (MCZC), 8 paratype males, and 4 paratype females (CMNH, FMNH, John R. MacDonald Collection [JRMC], LSUC, MCZC). Holotype label data: "PANAMÁ: Barro / Colorado Is. / Canal Zone," "Robert G. Beard / 2 July 1967 / at U.V. light," "HOLOTYPE male / Leptomantispa chaos / Hoffman / det. K. M. Hoffman 1991." Condition of holotype: color good, wings spread, forewing length 9.5 mm, abdomen detached, cleared, in glycerin-filled microvial attached to pin beneath labels. Paratypes have the following data associated with them: GUATEMALA: Alta Vera Paz Dept., Larquín, elev. 1000 ft., 11-VI-1948, R. D. Mitchell, Guatemala Zool. Exped. (1948), 1 female (FMNH); PANAMÁ: Canal Zone, Barro Colorado Island, 2-VII-1967, at U.V. light, Robert G. Beard, 2 females (MCZC); same data, 10-VII-196?, 1 female (MCZC); same locality, 4-IV-1959, at light, #720, H. S. Dybas, 1 male (FMNH); Canal Zone, Ft. San Lorenzo, 2-I-1983, E. Giesbert, 1 male (SDMC); Canal Zone, Gatun, Ridge Road, 29–30-III-1987, J. R. MacDonald, 2 males (JRMC; VENEZUELA: Aragua St., Rancho Grande, 1100 m, 5-VII-1967, R. W. Poole, 1 male (MCZC); same data, 20-VII-1967, 1 male (MCZC); FRENCH GUIANA: Saint Laurent du Maroni Dept., 13 km SSE of St. Laurent, 8-VI-1986, E. G. Riley and D. A. Rider, 1 male (LSUC); BRAZIL: PARÁ: Tucuruí, I-1979, M. Alvarenga, 1 male (CMNH).

Leptomantispa nymphe Hoffman, new species

(Figs. 588, 593, 598)

DIAGNOSIS. — Separated from other Costa Rican mantispines by the combination of prominent setae over the entire length of the pronotum in lateral view with most setae arising flush with the pronotal surface, pronotum yellow-brown to brown dorsally, mesoscutellum entirely yellow, forewing with subcostal space distinctly amber and the pterostigma reddish brown to brown.

MALE COLORATION. — Head dull yellow, vertex brown posteriorly except along ocular margins, reddish brown spot above and between antennae medially, sometimes extended posteriorly along midline, brown transverse stripe sometimes beneath antennae, stripe not surpassing antennal bases laterally, frons with distal half dark brown medially, reddish brown stripe along midline from frons and onto labrum; mandibles reddish brown, other mouthparts yellow to yellow-brown; antenna with scape yellow, brown posterodistally, pedicel dark reddish brown, flagellum very dark reddish brown; eyes metallic silver to purple. Prothorax with pronotum yellow-brown to brown dorsally, anterolateral corners somewhat darker; posterodorsal membrane brown, posteroventral membrane yellow; pleural sclerites and sternum yellow to light brown, membrane yellow; leg with coxa yellow, trochanter light brown, femur light brown to light reddish brown, base of spine row yellow-brown, tibia and tarsus brown. Pterothorax with nota brown, midline yellow, anterolateral corners of mesonotum yellow, yellow spots at wing bases, scutella yellow; pleura yellow, anterior membrane yellow medially, dark reddish brown marginally, all sclerites except metanepisternum and metanepimeron partly brown; legs each with coxa and trochanter brown, femur, tibia, and tarsus dull yellow; forewing with membrane hyaline, Sc space amber, pterostigma reddish brown to brown, 1AP with asperous region brown, most veins brown, RA pale yellow at base, most of AA and AP_1 pale yellow basally; hind wing similar to forewing, RA yellow for longer distance than in forewing, MP pale yellow at base. Abdomen with tergites yellow, I-III mostly dark brown medially, III-VIII reddish brown posteriorly, ectoprocts brown; pleura yellow anteriorly, dark brown posteriorly, or almost entirely dark brown; sternites yellow, IV-VII reddish brown posteriorly.

FEMALE COLORATION. — Same as for males, except for the following: pronotum with anterolateral surface of femur dark reddish brown medially; abdomen with tergites VI-IX mostly dark brown, ectoprocts yellow, brown distally and along inner margin, pleura VI-VII entirely dark brown to black, sternites VI-VII and gonocoxites dark brown.

THORAX. — Pronotum 6.7–8.1 times as long as wide at maculae in dorsal view; pterothoracic scutella with combined 2–4 pores on each side, pretarsal claws with four teeth each; males with both wings collectively on each side with combined 8–10 veins leaving RP posteriorly, females with 10 veins; forewing lengths of males 9.7–10.7 mm, of females 10.0–10.7 mm.

MALE PREGENITAL ABDOMINAL APPARATUS. — Tergites III-IV each with paired patches of 10–17 small circular pores total in one irregular transverse row on posterior margin on each side, rows slightly angled anteriorly near midline, tergites IV-V each with paired patches of 20–35 small circular pores in two transverse rows on each side anterolaterally, pores with small conical collars internally, tergites V-VI with intersegmental membrane invaginated into single-lobed pocket extending anteriorly 0.2–0.3 length of tergite V, tergite V three times as long as VI.

MALE TERMINALIA. — Ectoprocts each ovoid to crescent-shaped in dorsal view, apex rounded, sclerotized ventrad of ventromedial lobe, ventromedial lobe slightly flattened dorsoventrally, abruptly truncate along inner margin, covered with 20–30 short thickened setae; sternite IX pentagonal in ventral view, posterior margin broadly rounded medially; gonarcus with median lobe projecting from dorsal surface, flattened anteroposteriorly, slightly curved anteriorly, twice as long as wide, apex rounded; gonocoxites each three times as wide distally as basally in lateral view, abruptly widened at two-thirds length, apex truncate; mediuncus with anterior third transversely ovoid in lateral view, 2–3 times as high as remainder, apex forked in posterior view; pseudopenal membrane ovoid in posterior view, 1.3 times as long as wide, narrowed distally, covered with golden yellow dorsally-projecting microspines except for triangular region medially on basal third; hypomeres present as paired small knobs; pseudopenis sclerotized, spinelike in posterior view, as long as pseudopenal membrane and slightly longer than gonarcal median lobe, flattened anteroposteriorly.

FEMALE TERMINALIA. — Ectoprocts as long as gonocoxites; sternite VIII as long medially as laterally, five times as wide as long in lateral view, slightly curved posteriorly, posterior margin truncate medially; bursa with entrance entirely lightly sclerotized, remainder membranous to lightly sclerotized; spermatheca with proximal section slightly wider than medial section, distal section 1.5 times as wide as proximal, diverticula present as short medially-directed lobe on inner margin, shorter than width of spermatheca at that point, proximal section with first bend right laterad of medial section, medial section with two coils, bent anteriorly before distal section, distal section with 1.5 coils, fertilization canal duct sinuous; fertilization canal sloping basad of apex.

GEOGRAPHICAL DISTRIBUTION. — Costa Rica (LIMÓN); Panama (Canal Zone); French Guiana (Saint Laurent du Maroni).

ALTITUDINAL DISTRIBUTION. — Unknown for Costa Rica.

ADULT FLIGHT PERIOD. — March in Costa Rica; elsewhere in June, July, and December.

ETYMOLOGY. — Name derived from the Greek noun *nymphe*, which is a maiden-spirit inhabiting trees, mountains, and bodies of water. The name is in reference to the forested regions of Central and South America inhabited by this species.

TYPE MATERIAL. — Holotype male (USNM), four paratype males and four paratype females (CHAH, CUAC, LSUC). Holotype label data: "COSTA RICA: Limón / Río Uatsi, 8 km (air) / W Bribri / 9.62°N, 82.90°W / 25.iii.1987, el. 60 m / Holzenthal, Hamilton, Heyn," "HOLOTYPE male / Leptomantispa / nymphe Hoffman / det: K. M. Hoffman 1991." Condition of holotype: color somewhat discolored, both eyes damaged, wings unspread, forewing length 10.3 mm. Paratypes have the following data associated with them: COSTA RICA: Limón Prov., Río Uatsi, 8 km (air) W Bribri, 9.62°N, 82.90°W, el. 60 m, 25-III-1987, Holzenthal, Hamilton, Heyn, 2 males and 3 females (CUAC). PANAMÁ: Canal Zone, 6 km S Gatún, 30-XII-1972, Strauch, 1 female (CUAC); Canal Zone, Pipeline Road, 10 km NW Gamboa, 9°11′N, 79°46′W, 25-VII-1977, H. A. Hespenheide, 1 male (CHAH); FRENCH GUIANA: Saint Laurent du Maroni Dept., 13 km SSE St. Laurent, 8-VI-1986, collected at mercury vapor light, E. G. Riley and D. A. Rider, 1 male (LSUC).

Leptomantispa pulchella (Banks, 1912) [new combination]
(Figs. 579, 585, 586, 608)

Diagnosis. — Separated from other Costa Rican mantispines by the combination of prominent setae over the entire length of the pronotum in lateral view with most setae arising flush with the pronotal surface, the mesoscutellum brown medially and yellow laterally, the mesofemur with a longitudinal brown stripe ventrally, the forewing with subcostal space hyaline and the pterostigma light red.

Geographical Distribution. — Southwestern Canada south to Costa Rica, including Cuba.

Altitudinal Distribution. — Unknown.

Adult Flight Period. — May.

Habitat Preference. — Unknown.

Xeromantispa Hoffman, new genus

Type Species. — *Mantispilla scabrosa* Banks, by monotypy.

Description. — Head with shortest distance between eyes wider than width of one eye at ventral margin of antennal sockets in frontal view, usually with distinct elliptical hump posteriad of antennal bases medially, longer than wide and distinctly concave medially, antennal flagellum at mid-length with flagellomeres twice as wide as long in anterior view. Pronotum straight in lateral view, 4.4–5.0 times as long as wide at maculae in dorsal view, dorsal surface with numerous short thick setae, setal bases not elevated. Pterothorax with mesoscutal furrow prominent, mesonotum with numerous short thick setae, meso- and metascutelli with combined 3–5 pores on each side; legs each with tarsomere I as long as tarsomeres II-V combined, tarsal claws with 5–6 teeth each; both wings collectively on each side with combined 9–14 veins leaving RP posteriorly, forewing length 10.2–17.5 mm, sc-ra at 0.5–0.7 length of 3RA, Sc distal to sc-ra at 45–55° to RA distally, 3RA with one c-ra crossvein distal to Sc, AA and 1AP with posterior half asperous; hind wing with CuA strongly angled toward AA, cu-aa crossvein either very short or absent and with CuA briefly fused with AA. Male abdomen with tergite III lacking pores, tergites IV-V with 42–69 pores anterolaterally on each side, most in transverse U-shaped row, anterior row longer than posterior row and nearly reaching midline, several pores inside U and usually 1–2 isolated pores at mid-length laterally, pores circular with short sclerotized conical collars internally, most pores in anterior row each with 1–3 long setae arising from anterior margin which overlap pores in posterior row, other pores each with one seta arising from within; intersegmental membrane between tergites V-VI invaginated into single-lobed pocket extending 0.4 length of tergite V, tergite V twice as long as VI. Male terminalia with each ectoproct oval in dorsal view, apex broadly rounded ventromedial lobe rounded, wider than long, directed medially, lightly sclerotized, with 35–46 short thickened setae; sternite IX subquadrate in ventral view, wider than long, posterior margin produced into apically-concave subquadrate lobe with posterolateral corners rounded, wider than long; gonarcus with medial lobe 1.5 times as long as wide, somewhat square in dorsal view, flattened anteriorly, posterior surface flattened basally and anteriorly curved distally, apex rounded in posterior view, gonarcus with anterior margin produced dorsally behind lobe into anteroposteriorly-flatttened flange, flange wider than high, rounded dorsolaterally and deeply concave medially; gonarcal membrane unmodified; gonocoxites each as wide distally as basally, apical fourth narrowed to a blunt spine dorsally and slightly bent laterally; mediuncus with anterior two-fifths horizontally ovoid in lateral view, twice as high as distal three-fifths, apex forked in posterior view; pseudopenal membrane ovoid in posterior view, sclerotized; hypomeres present as paired very small granules, 1–2 on each side; pseudopenis triangular in posterior view, somewhat shorter than pseudopenal membrane, twice as long as wide at base, lightly sclerotized, flattened anteroposteriorly, base nearly as wide as mediuncal fork, apex pointed; hypandrium internum triangular in ventral view, shallow and nearly straight in lateral view. Female terminalia with ectoprocts 1.2–1.5 times as long as gonocoxites; sternite VIII entire, slightly longer medially than laterally, posterior margin shallowly concave medially; bursa membranous; spermatheca with proximal section slightly wider than medial section, distal section slightly narrower than proximal section, diverticula present as low, narrow, transverse ridge, medial portion with from two bends to two complete coils with connecting bend inside coils, fertilization canal duct curved basally, basal half dark, fertilization canal sloping basad of apex.

CHROMOSOME COMPLEMENT. — Unrecorded.

IMMATURE STAGES. — Undescribed.

BIOLOGY. — Adults have been collected at lights and in pine-oak forests. Nothing is known of immature stages.

GEOGRAPHICAL DISTRIBUTION. — Southwestern Unted States and northern Mexico.

ETYMOLOGY. — A combination of the Greek adjective *xero*, meaning arid, and *mantispa* as coined by Illiger (1798), which is a combination of the Greek noun *mantis*, meaning soothsayer or prophet, and the suffix *pa*, which is derived either from the Greek *para*, meaning near or beside, or from the Latin *par*, meaning equal. The name refers to the arid climate prevalent in the region where the type species occurs. Gender is feminine.

REMARKS. — Although this genus has a distribution outside the scope of this monograph, it was deemed important to include the genus for completeness of coverage of the New World fauna. Costa Rica contains all newly recognized New World genera, except *Xeromantispa*, and with its inclusion the reader will have access to information covering all New World genera previously placed in the Old World genus *Mantispa*.

Zeugomantispa Hoffman, new genus

TYPE SPECIES. — *Mantis minuta* Fabricius, 1775 by present designation.

DESCRIPTION. — Head with shortest distance between eyes narrower than width of one eye at ventral margin of antennal sockets in frontal view, antennal flagellum at mid-length with flagellomeres 1.3–1.8 times as wide as long in anterior view. Pronotum straight in lateral view, 5.2–7.2 times as long as wide at maculae in dorsal view, dorsal surface with numerous fine setae (Fig. 609), setal bases distinctly elevated. Pterothorax with mesoscutal furrow prominent, pterothoracic scutella with 2–9 pores total on each side; legs each with tarsomere I distinctly longer than tarsomeres II-V combined, pretarsal claws with 3–5 teeth each; both wings collectively on each side with combined 6–17 veins leaving RP posteriorly, forewing length 6.0–16.5 mm, pterostigma with sc-ra at 0.5–0.7 length of 3RA (Fig. 590), distal end of Sc at 40–50° angle to RA, 3RA with one c-ra crossvein distal to Sc, CuP with ends of terminal fork convergent and distinctly closer together than at base of fork, AA and AP_1 simple, 1AP asperous along AP_2; hind wing with CuA strongly angled toward AA, cu-aa crossvein very short or absent with CuA briefly fused with AA, jugal lobe with margin angulate. Male abdomen with intersegmental membrane between tergites III-IV and IV-V invaginated into paired bilobed pockets extending anteriorly 0.1–0.5 length of tergite V, each lobe with 1–10 pores. Male terminalia with each ectoproct ovoid to crescent-shaped in dorsal view, apex rounded, ventromedial lobe absent or barely present, ovoid patch of 20–47 short thickened setae ventromedially, lightly sclerotized ventrad of setae; sternite IX pentagonal in ventral view, posterior margin produced into short, slightly ventrally-directed, rounded lobe medially; gonarcus with dorsal apex produced into medial lobe in lateral view; each gonocoxite up to three times wider distally than basally in lateral view, apex narrowly rounded; mediuncus uniform in height in lateral view, apex truncate or forked in posterior view; pseudopenal membrane triangular, unsclerotized; hypomeres present as 2–4 small granules in longitudinal line on each side, often coalesced; pseudopenis sclerotized, spinelike in posterior view, as long as pseudopenal membrane and median gonarcal lobe;

hypandrium internum triangular in ventral view, shallow and nearly straight in lateral view. Female terminalia with sternite VII lengthened beneath tergite VIII; ectoprocts as long as or slightly shorter than gonocoxites; sternite VIII reduced, very short, medial third often present only as transverse line of setae; bursa lightly sclerotized to membranous; spermatheca with proximal and medial sections equal in width, distal section twice as wide as proximal, diverticulae present as transverse rod connected medially to spermatheca, lateral arm sometimes reduced or absent, proximal section with first bend laterad of medial section, medial section spiralling anteriorly for up to 1.5 loops before abruptly bending posteriorly, distal section spiralling posteriorly for 1.0–1.5 loops and intertwining with medial section, fertilization canal duct curved to sinuous, fertilization canal truncate or sloping basad of apex.

CHROMOSOME COMPLEMENT. — Diploid chromosome complement of 20, consisting of 18 autosomes and 2 sex chromosomes based on *Z. minuta* (Hughes-Schrader, 1969). Sex chromosomes of males are XY and those of females are XX.

IMMATURE STAGES. — All immature stages of *Z. minuta* have been described (Hoffman and Brushwein 1992). The stalked eggs are oval with a caplike micropyle and are typical for mantispines. First instars are diagnosed as follows: head capsule pale white, thoracic and abdominal terga with paired reddish brown stripes laterally; mandible with one tooth on inner margin at three-fourths length, antennal scape cylindrical, longer than wide; legs with tarsus longer than wide, unguitractor process one-fourth as wide as tarsus and as long as tarsal claw, empodium twice as wide distally as basally; abdominal segments I-VI with setae D4, SD3, and L2 at most barely reaching posterior margins of segments. Second and third instars are diagnosed as follows: legs with tarsus conical, claw present; second instar with abdominal segment X longer than IX, tapered posteriorly; third instar with abdominal segment X as long as or longer than IX, spigot three times as long as base. Pupae are diagnosed as follows: abdominal tergites III-IV each with setae 2–3 times as long as height of dorsal hooks in lateral view, tergite IX with setae in two transverse rows laterally.

BIOLOGY. — Adults have been captured at lights and on various plants. Immatures of *Z. minuta* have been recorded from the egg sacs of 29 spider species belonging to 14 families, including several web-building species (Hoffman and Brushwein 1992); *Z. viridula* has been reared from the egg sacs of two species in two families; and an adult of *Z. compellens* emerged from the egg sac of an unidentified orb weaver (Araneae: Araneidae). First instars of *Z. minuta* are obligate egg sac penetrators, are very active, and have been shown to orient toward isolated spider egg sacs from a distance (Redborg and MacLeod 1985). Valerio (1971) reported on some aspects of the biology of *Z. minuta* (cited as *Mantispa viridis* Walker) in Costa Rica.

GEOGRAPHICAL DISTRIBUTION. — Eastern United States south to Argentina, including Cuba.

ETYMOLOGY. — A combination of the Greek adjective *zeugo*, meaning twinned, and *mantispa* as coined by Illiger (1798), which is a combination of the Greek noun *mantis*, meaning a prophet or soothsayer, and the suffix pa, which is derived either from the Greek *para*, meaning near or beside, or the Latin *par*, meaning equal. The name is in reference to the two sets of invaginated intertergal membranes between tergites III-IV and IV-V of males. Gender is feminine.

DISCUSSION. — This genus contains three species occurring from the eastern United States south to Argentina, including Cuba. All three species occur in Costa Rica, and they can be distinguished by the combination of prominent setae arising from distinct bumps on the pronotum and the forewing with Sc distal to sc-ra at a 30° angle to RA

KEY TO COSTA RICAN *ZEUGOMANTISPA*

1. Most wing veins uniformly brown, thoracic nota mostly brown, profemur usually with brown spot at base of major spine anterolaterally . . . . *Z. compellens*

1′. Wing veins yellow or green, mottled with brown at vein junctions, thoracic nota yellow to green, profemur sometimes with red spots at base of major spine both antero- and posterolaterally 2

2(1′). Antennal scape entirely green, forewing with aa-ap crossvein curved posteriorly (Fig. 590), nearly parallel with posterior wing margin, 1AA elliptical with posterodistal angle pointed, posterobasal angle distinctly different from posterodistal angle . . . . *Z. minuta*

2′. Antennal scape red posteriorly, forewing with aa-ap straight (Fig. 591), at distinct angle to posterior wing margin, 1AA rectangular, posterobasal angle similar to posterodistal angle . . . . *Z. viridula*

Zeugomantispa compellens (Walker, 1860) [new combination]
(Figs. 589, 594, 599)

DIAGNOSIS. — Separated from other Costa Rican mantispines by the combination of prominent setae arising from distinct bumps on the pronotum, the mostly brown thoracic nota, wing veins mostly uniformly brown, and the forewing with Sc distal to sc-ra at a 30° angle to RA.

GEOGRAPHICAL DISTRIBUTION. — Central Mexico south to southern Brazil. Within Costa Rica specific localities are as follows: CARTAGO: Turrialba; GUANACASTE: Rincón National Park; Santa Rosa National Park; 3 km SE Río Naranjo; HEREDIA: La Selva Biological Station, 3 km S Puerto Viejo, 10°26′N, 84°01′W; Finca La Selva Verde, 12 km S Puerto Viejo; LIMÓN: Río Banaño, 16 km WSW Bomba, 9.888°N, 83.167°W; Hacienda Tapezco, 29 air km W Tortuguero, 10°30′N, 83°47′W; Río Uatsi, 8 km (air) W Bribri, 9.62°N. 82.90°W; PUNTARENAS: Golfito.

ALTITUDINAL DISTRIBUTION. — 40–300 m.

ADULT FLIGHT PERIOD. — February to April, June to September, November, and December.

HABITAT PREFERENCE. — Unknown.

Zeugomantispa minuta (Fabricius, 1775) [new combination]
(Figs. 590, 595, 600, 609)

DIAGNOSIS. — Separated from other Costa Rican mantispines by the unique structure of the forewing with the aa-ap crossvein curved posteriorly and nearly parallel with posterior wing margin so that cell 1AA is elliptical with the posterodistal angle pointed and distinctly different from the posterobasal angle. Other characters include: the combination of the antennal scape being entirely green, prominent setae arising from distinct bumps on the pronotum, the yellow to green thoracic nota, the wing veins yellow or green and mottled with brown at vein junctions, and the forewing with Sc distal to sc-ra at a 30° angle to RA.

GEOGRAPHICAL DISTRIBUTION. — Eastern U.S.A. south to Venezuela, including Cuba. Within Costa Rica it is known from the provinces of Cartago, Guanacaste, Heredia, Puntarenas, and San José. Specific localities are as follows: CARTAGO: Cartago; 14.5 km (9 mi) NW Esparta, Turriabla, IICA Station; Turrialba; GUANACASTE: near Arenal, 10°20′N, 84°50′W; Playas del Coco; Taboga; Hacienda Tempisquito (Pelon de la Altura) 1 km NE of km 265, rt 1, 10.84°N, 85.56°W; Las Cañas, Río Corobici; S. Cañas, Experiment Station; La Pacifica, nr. Cañas; 2 mi NW of Cañas; Hacienda La Pacifica, 5 km NW Cañas; Hacienda La Pacifica, 6 km N Cañas; 14 km S Cañas; 20 km SW Cañas; La Pacifica, 37 km (23 mi) NW Cañas; 3 km SE Río Naranjo; Parque Nacional Guanacaste, El Hacha, Quebrada Alcornoque, 11.009°N, 85.577°W; Parque Nacional Guanacaste, Maritza, Río Tempisquito, 10.958°N, 85.497°W; Parque Nacional Rincón de la Vieja, Río Negro, 10.765°N, 85.313°W; Río Gongora (sulfur mine), 4 km (air) NE Quebrada Grande, 10.887°N, 85.470°W; Playa Hermosa; Santa Rosa National Park; La Pacifica, 4 km NW Cañas; HEREDIA; San Rafael Vara Blanca; PUNTARENAS: Boca de Barranca; Monteverde; 8.1 km (5 mi) E of Judas, CR-38; 25.5 km (15.8 mi) W of San José, 8.1 km (5 mi) E Judas, CR-38; SAN JOSÉ: San José, Universidad de Costa Rica; San José; Fadra La Caja, 8 km W San José.

ALTITUDINAL DISTRIBUTION. — 100–2200 m.

ADULT FLIGHT PERIOD. — Year round in Costa Rica.

HABITAT PREFERENCE. — Unknown.

REMARKS — Three names recorded in the literature from Costa Rica are here synonymized with *Zeugomantispa minuta*. They are: *Mantispilla flavicornis* Navás, 1930 [**new synonymy**]; *Mantispilla rubricata* (Navás, 1924) [**new synonymy**], and *Mantispilla viridata* (Navás, 1924) [**new synonymy**]. The North American name *Mantispa viridis* Walker, 1853 is also a **new synonym** of *Zeugomantispa minute.*

Zeugomantispa viridula (Erichson, 1839) [new combination]
(Figs. 541, 591, 596, 601)

DIAGNOSIS. — Separated from other Costa Rican mantispines by the combination of the antennal scapes being red posteriorly, prominent setae arising from distinct bumps on the pronotum, the yellow to green thoracic nota, wing veins yellow or green and mottled with brown at vein junctions, the forewing with Sc distal to sc-ra at a 30° angle to RA, and the forewing with aa-ap straight and at a distinct angle to posterior wing margin so that cell 1AA is rectangular with the posterobasal angle similar to posterodistal angle.

GEOGRAPHICAL DISTRIBUTION. — This species occurs from central Mexico south to Argentina. Within Costa Rica specific localities are as follows: ALAJUELA, 2 km NE Bijagua; Parque Nacional Rincón de la Vieja, Quebrada Provision, 10.769°N, 85.281°W; Reserva Forestal San Ramón, Río San Lorencito and tribs., 10.216°N, 84.607°W; GUANACASTE: Comelco Property; Las Cañas, Río Corobici; La Pacifica, nr. Cañas; Hacienda La Pacifica, 5 km NW Cañas; 14 km S Cañas; 3 km SE Río Naranjo; Santa Rosa National Park; Quebrada Garcia, 10.6 km ENE Quebrada Grande, 10.862°N, 85.428°W; HEREDIA: Finca La Selva Verde, 12 km S Puerto Viejo; La Selva Biological Station, 3 km S of Puerto Viejo, 10°26'N, 84°01'W; 1 km S Puerto Viejo; Río Bijagual on road to Magsasay, 10.408°N, 84.076°W; San Rafael Vara Blanca, 2200 m; LIMÓN: Pandora; Río Banaño, 16 km WSW Bomba, 9.888°N, 83.167°W; Río Uatsi, ca. 8 km (air) W Bribri, 9.62°N, 82.90°W; PUNTARENAS: 3.2 km (2 mi) SW San Vito de Java; La Amistad National Park, 8°57'N, 82°50'W; Finca Las Cruces, 6 km S San Vito de Java.

ALTITUDINAL DISTRIBUTION. — 60–2200 m.

ADULT FLIGHT PERIOD. — Every month except August.

HABITAT PREFERENCE. — Unknown.

SUBFAMILY SYMPHRASINAE

Two of the three genera of the Symphrasinae occur in Costa Rica, each represented by a single species. Larvae have three instars and are hypermetamorphic with the first instar campodeiform and the last two scarabaeiform (Parker and Stange 1965). Members of the Symphrasinae have been reared from the nests of aculeate Hymenoptera and from pupae of Lepidoptera, and have been associated with the pupae of Coleoptera and Diptera.

Plega Navás, 1927

Plega contains 14 species occurring from the southwestern United States south to Bolivia and Brazil, only one of which is known from Costa Rica. Adults of the genus have been associated with pupae of Scarabaeidae (Coleoptera), Asilidae (Diptera), Noctuidae (Lepidoptera), and various Hymenoptera (Anthophoridae, Megachilidae, Sphecidae, and Vespidae: Eumeninae) (Parker and Stange 1965; Werner and Butler 1965; Penny 1982).

Plega hagenella (Westwood, 1867)
(Figs. 538, 543, 548, 553)

DIAGNOSIS. — Separated from other Costa Rican mantispids by the combination of a sub-basal spine on the profemur and its two-piece pronotum.

GEOGRAPHICAL DISTRIBUTION. — This species is recorded from Costa Rica, Colombia and Brazil. Within Costa Rica it was recorded by Navás (1924) as *Symphrasis signata* Hagen from an unspecified locality, and has been subsequently collected in the specific localities as follows: GUANACASTE: S Cañas; 14 km S Cañas; 3 km SE Río Naranjo; Santa Rosa National Park; HEREDIA: La Selva Biological Station, 3 km S Puerto Viejo, 10°26′N, 84°01′W.

ALTITUDINAL DISTRIBUTION. — 180–300 m.

ADULT FLIGHT PERIOD. — January to March, May to July, and November to December.

HABITAT PREFERENCE. — Unknown.

Trichoscelia Westwood, 1852

Trichoscelia contains 13 species occurring from southern Mexico south to Argentina, only one of which is known from Costa Rica. Penny (1982) revised the Brazilian species, but the Central American and northern South American species are poorly known and it is not possible to confidently identify species at this time. Three species have been described from southern Mexico and one from northern Colombia. I have chosen to assign the present species from Costa Rica to the oldest available name, which is the one from Colombia. Future revisions of *Trichoscelia* may or may not support this decision. Adults of this genus have been reared from the nests of *Polybia* species (Hymenoptera: Vespidae: Polistinae) (Penny 1982).

Trichoscelia remipes (Gerstaecker, 1888)
(Figs. 537, 539, 542, 549, 554)

DIAGNOSIS. — Separated from other Costa Rican mantispids by the lack of a sub-basal spine on the profemur.

GEOGRAPHICAL DISTRIBUTION. — This species was described from Colombia and is now known to occur in Costa Rica as well. Within Costa Rica specific localities are as follows: GUANACASTE: Parque Nacional Rincón de la Vieja, Río Negro, 10.765°N, 85.313°W; HEREDIA: La Selva Biological Station, 3 km S Puerto Viejo, 10°26′N, 84°01′W.

ALTITUDINAL DISTRIBUTION. — 810 m.

ADULT FLIGHT PERIOD. — March, May, and July.

HABITAT PREFERENCE. — Unknown.

FAMILY MYRMELEONTIDAE

by
Lionel A. Stange

The members of this family are called antlions in reference to the characteristics of the larvae. The actual name is derived from ancient references to animals with the head of a lion and the body of an ant, but today we think of antlions as being voracious predators on ants. Antlion larvae are superbly suited to digging in the soil or loose sand and nearly all species, where the biology is known, have this digging ability. However, most people associate antlions with the funnel shaped pitfall traps that can be abundant in areas such as sand dunes. Many hundreds of years ago the Mimbres Indians of New

Mexico depicted antlion larvae on their pottery. Most of the pitfall builders belong to the tribe Myrmeleontini (but some others are found in other tribes, although they often have different structures to their pitfalls which in the case of certain Brachynemurini are built in hardpan soils. In Costa Rica there are four tribes of antlions, but most species belong to the tribe Nemoleontini, which do not make pitfall traps. The larvae of this group live in sand (*Purenleon*, *Dimarella*), in cave mouths (*Eremoleon*) or in sawdust in rotten trees (*Glenurus*). The tribe Acanthaclisini is represented by the genus *Vella*, which are giant antlions. Their larvae live in deep sand and can only move backwards and often prey on the larvae of *Myrmeleon* which only move backwards as well. The fourth tribe of antlions represented in Costa Rica is the Brachynemurini which are represented by two genera, *Dejuna* and *Abatoleon*. The larvae of these genera are free living in sand. Adult antlions fly at night and apparently copulate and oviposit in the early evening and then spend the rest of the night looking for food which may consist of sessile insects such as aphids, or lepidopterous caterpillars, or even other antlion adults. Some species are known to be attracted to night blooming flowers and may eat pollen, but very little is known of the Costa Rican species. During the day adults rest on grasses (*Dejuna*, *Abatoleon*, *Myrmeleon*), on rock surfaces or on tree trunks or posts (*Vella*). Many species of antlions are attracted to lights but others are not . The rarer species can most easily be collected by finding the larvae. Larvae can be sifted from the sand or exposed in restricted habitats such as tree bases or in cave mouths by blowing away the substrate with an aspirator. Usually the larvae can be reared easily.

KEY TO THE GENERA OF COSTA RICAN MYRMELEONTIDAE

ADULTS

1. Metafemur with elongate sense hair (Fig. 616); hind wing vein CuA unites with posterior fork of MP_2 shortly after fork (Fig. 613); distal segment of labial palpus with sensory area (palpimacula) elongate and slit-like (Fig. 614); large (forewing length over 50 mm), robust and hairy insects (Fig. 615) . . . . (Tribe Acanthaclisini) . . . . *Vella*

1′. Metafemur without elongate sense hair; hind wing vein CuA running to hind margin, usually connected to posterior fork of MP_2 by crossveins; distal segment of labial palpus with sensory area oval-shaped; small to medium species (forewing less than 50 mm), usually fragile and not extremely hairy 2

2(1′). Forewing vein 2A evenly curved from base to hind margin; forewing vein CuP originates well distad of basal crossvein (Fig. 611); male ectoproct with distinctive postventral lobe . . . (Tribe Brachynemurini) 3

2′. Forewing vein 2A runs close to vein 1A for a short distance, then bends at sharp angle toward 3A; forewing vein CuP originates at level of basal crossvein (Fig. 612); male ectoproct without postventral lobe (except *Dimarella*) 4

3(2). Ocular rim with 1 or more setae that project over eye; forefemur with row of distally swollen setae on exterior face; male ectoproct with postventral lobe less than three times longer than middle diameter; female abdomen longer than forewing . . . . *Abatoleon*

3′. Ocular rim without setae; forefemur with or without row of setae, if present, setae not distally swollen; male ectoproct with postventral lobe more than eight times longer than middle diameter; female abdomen shorter than forewing . . . . *Dejuna*

4(2′). Hind wing with radial sector arising beyond cubital fork, four or more presectoral crossveins present; male pilula axillaris present; distal tarsomere with ventral setae less than one-half as long as tarsomere diameter . . . . (Tribe Myrmeleontini) . . . . *Myrmeleon*

4′. Hind wing with radial sector arising before cubital fork, only one presectoral crossvein present; male pilula axillaris absent; distal tarsomere with ventral setae at least as long as tarsomere diameter . . . (Tribe Nemoleontini) 5

5(4′). Antennal socket separated by more than greatest width of antennal pedicel from ocular rim; posterior fork of forewing vein CuA and vein CuP + 1A parallel with each other and hind margin for long distance; male ectoproct with elongate postventral lobe . . . . *Dimarella*

5′. Antennal socket separated by less than greatest width of antennal pedicel from ocular rim; posterior fork of forewing vein CuA at an oblique angle to hind margin; male ectoproct without elongate postventral lobe 6

6(5′). Forefemur swollen, at widest point much wider than interantennal distance with abundant pubescence, especially on closing surface; femoral sense hair of foreleg over one-half length of femur . . . . *Purenleon*

6′. Forefemur slender and elonsgate, at widest point about equal at most to interantennal distance, with sparser pubescence; femoral sense hair of foreleg less than one-third length of femur 7

7(6′). Pretarsal claws capable of closing against distal tarsomere, which has brush of specialized setae on ventral surface on distal one-half . . . . *Elachyleon*

7′. Pretarsal claws not capable of closing against distal tarsomere 8

8(7′). Forewing costal area with single series of cells for most of distance; apical one-fifth of hind wing and usually forewing with predominant dark brown suffusion in marked contrast to basal one-fifth (Figs. 629–631) . . *Glenurus*

8′. Forewing costal area with double series of cells for most of distance (Figs. 633, 636); apical one-fifth of wings predominantly transparent, sometimes with many scattered dark brown spots . . . . *Eremoleon*

LARVAE

(unknown: *Elachyleon punctipennis*; *Dimarella garciai*; *Eremoleon* species)

1. Labial palpus shorter than basal width of mandible; mesothoracic spiracle not borne on a tubercle; head without dolichasters; can only move backwards 2

1′. Labial palpus longer than basal width of mandible or mesothoracic spiracle borne on a tubercle; head often with dolichasters; move forwards and backwards 3

2(1). Mandible with some setae on outer lateral margin as long as or longer than greatest mandibular width; sternite VIII with pair of inconspicuous submedian processes near posterior margin; make pitfall traps . . . . *Myrmeleon*

2′. Mandible with longest setae on outer lateral margin less than one-half greatest mandibular width; sternite VIII without teeth on subapical margin; do not make pitfall traps . . . . *Vella fallax*

3(1′). Mandible with distal tooth shorter than middle tooth and usually set at different angle than other teeth . . . . (Brachynemurini) 4

3′. Mandible with distal tooth as long as or longer than middle, teeth parallel . . . . . (Nemoleontini) 5

4(3). Sternite VIII with submedian pair of sclerotized processes near posterior margin . . . . *Abatoleon*

4′. Sternite VIII without sclerotized processes . . . . *Dejuna*

5(3′). Mandible with two teeth; abdomen with scoli . . . . *Glenurus*

5′. Mandible with three teeth; abdomen without scoli 6

6(5′). Lateral abdominal spiracles situated on well raised tubercles 7

6′. Lateral abdominal spiracles more or less sessile, not on tubercles 8

7(6). Lateral abdominal spiracles with papilliform tubercles beset with short dolichasters . . . . *Purenleon debilis*, *Purenleon iniquus*

7′. Lateral abdominal spiracles with bulbous tubercles not beset with dolichasters . . . . *Dimarella angusta*

8(6′) Larvae live under rock overhangs or in caves . . . . *Eremoleon*

8′. Larvae do not live under rock overhangs nor cave mouths . . . . *Dimarella mixteca*, *Purenleon parallelus*

TRIBE ACANTHACLISINI

This tribe is composed of 14 described genera found in most of the temperate and tropical world. Most of the species are large, robust and hairy, with well-developed tibial spurs and pretarsal claws. This is true of the only genus of the tribe in Costa Rica, *Vella* Navás.

Vella Navás, 1913

This genus contains six species restricted to the Western Hemisphere. *Vella fallax* (Rambur) extends from southwestern United States to Argentina and is the only species recorded from Costa Rica. The adults are attracted to lights and during the day rest on tree trunks or on posts. The larvae live in deep sand and can only move backwards in search of their prey, which may include other antlion larvae.

Vella fallax (Rambur, 1842)
(Figs. 613–616)

DIAGNOSIS. — Large antlions with a body length between 45 and 60 mm and a wing span reaching 160 mm. The wings are relatively unmarked with a biareolate forewing costal area (Fig. 613). One unique venational character of this species in Costa Rica is the hind wing vein CuA which unites with the posterior fork of MP_2 shortly after fork. Another unique feature of this species (in Costa Rica) is the presence of an elongate femoral sense hair on the hind femur (Fig. 616).

GEOGRAPHICAL DISTRIBUTION. — U.S.A. (AZ, TX) south to Argentina. In Costa Rica there are records from GUANACASTE: Santa Rosa National Park.

ALTITUDINAL DISTRIBUTION. — 300 m (Guanacaste).

ADULT FLIGHT PERIOD. — July to January in Costa Rica.

HABITAT PREFERENCE. — This species should be found in many lowland areas where there exists enough deep sand to support the larvae. It should be found in some of the beach areas of Costa Rica.

TRIBE BRACHYNEMURINI

This tribe is restricted to the Western Hemisphere. Only one genus (*Dejuna* Navás) has been collected in Costa Rica to date, but it is likely that species of *Abatoleon* Banks will be found in the future, since there are records from Mexico and Colombia. Members of this tribe differ from all other groups in Costa Rica in having the forewing vein CuP originating well distad of basal crossvein (sometimes obsolete) (see Fig. 611). Also, the male ectoproct has an elongate postventral lobe (found only in *Dimarella* in Costa Rica) and the forewing vein 2A runs in a fairly even curve to hind margin. The larvae have a distinct mandibular dentition, in which the distal tooth is shorter than the middle tooth and is usually set at a different angle than the other teeth.

Dejuna Navás, 1924

The species of this genus are known only from the arid tropical areas of Mexico and Central America. The adults are mostly straw colored and rest on dry grasses during the day except for the aberrant species, *Dejuna mimica*, which is brown and has been found resting on dry plant stems. In Costa Rica, the males are easily distinguished from other species (except those of *Dimarella*) by the ectoproct which has an elongate postventral lobe that is more than four times longer than its middle diameter. The males of *Dejuna* have a well-developed pilula axillaris which is absent in *Dimarella*.

KEY TO COSTA RICAN *DEJUNA*

1. Forefemur with row of white bristles for most of distance on exterior face (Fig. 628); tibial spurs of midleg equal to at least length of basal two tarsomeres; distal palpimere of labial palpus nearly as long as interocular distance below antennae (Fig. 626) . . . . *D. setosa*

1′. Forefemur without bristles on exterior face except sometimes subapically (Fig. 624); tibial spurs of midleg no longer than basitarsus; distal palpimere of labial palpus much shorter than interocular distance (Fig. 623) 2

2(1′). Brown colored (Fig. 625); femoral sense hair absent; setae on legs abbreviated, none longer than width of femur (Fig. 624) . . . . *D. mimica*

2′. Straw colored; femoral sense hair present and well developed; some setae on legs longer than width of femur . . . . *D. fenestrata*

Dejuna fenestrata (Banks, 1913) [new combination]
(Fig. 620)

DIAGNOSIS. — This straw colored species is closest in appearance to *Dejuna setosa* but has a shorter labial palpus, lacks the row of white bristles on the exterior face of the forefemur and has broader wings (Fig. 620). The adult length ranges from about 19 mm (female) to 29 mm (male).

GEOGRAPHICAL DISTRIBUTION. — This species is known from Guatemala, Honduras and Costa Rica. The type specimen was collected at ALAJUELA: Turricares; and other specimens were collected in GUANACASTE: Santa Rosa National Park.

ALTITUDINAL DISTRIBUTION. — 300 m.

ADULT FLIGHT PERIOD. — October to January.

HABITAT PREFERENCE. — The adults rest on grasses during the day. The species congregate in fairly large numbers.

Dejuna mimica (Stange, 1970) [new combination]
(Figs. 621, 623–625)

DIAGNOSIS. — This relatively small antlion (Fig. 621) (body length 19 to 23 mm) has reduced leg setae and lacks the femoral sense hair (Fig. 624). This latter feature is unique among Costa Rican antlions. The species resembles those of the genus *Atricholeon* Stange which is found in the southwestern United States and Mexico.

GEOGRAPHICAL DISTRIBUTION. — This species is known from southern Mexico, Guatemala, Honduras, and Costa Rica. The species was collected in Costa Rica in GUANACASTE: Santa Rosa National Park.

ALTITUDINAL DISTRIBUTION. — 300 m.

ADULT FLIGHT PERIOD. — March and April.

HABITAT PREFERENCE. — Unknown.

REMARKS. — Stange (1970) found males resting with the abdomen held out at about a 45 degree angle from the plant stem.

Dejuna setosa (Stange, 1970) [new combination]
(Figs. 622, 626–628)

DIAGNOSIS. — One outstanding diagnostic character of this species is the elongate labial palpus that is about equal in length to the interocular distance at the level of the antennae (Fig. 626). Also, the forefemur has a row of white bristles (Fig. 628) and other bristles are found on the mesoscutellum and posterolateral margin of the pronotum. This species (Fig. 622) is about the same size as *D. fenestrata* (body length 25 to 29 mm) and is also straw colored (Fig. 627).

GEOGRAPHICAL DISTRIBUTION. — This species is known from southern Mexico, Nicaragua and Costa Rica. The only locality known for this rather rare species in Costa Rica is GUANACASTE: Santa Rosa National Park.

ALTITUDINAL DISTRIBUTION. — 300 m.

ADULT FLIGHT PERIOD. — March and April.

HABITAT PREFERENCE. — Unknown.

TRIBE MYRMELEONTINI

This is a very distinct and morphologically conservative tribe that has larvae that can build pitfall traps in the sand and only move backwards. One unique structural characteristic of this tribe is the chaetotaxy of the distal tarsomere. All setae on the ventral side of the distal tarsomere are very short, less than one-half the diameter of the tarsomere. Also, the hind wing radial sector arises beyond the cubital fork with at least four presectoral crossveins.

Myrmeleon Linnaeus, 1767

This cosmopolitan genus has 165 described species and thus rates as the largest genus in the family. However, much taxonomic revision is needed for most areas of the world. Larvae from all parts of the world appear to be structurally nearly identical, and the adults offer few striking characters, although the male genitalia appear to be distinctive for each species. A vast literature exists concerning the pit making activities of *Myrmeleon*, especially in Europe and the United States. Usually there are several species at any one locality. The species (e.g., *Myrmeleon timidus*) make pitfall traps, occasionally in open areas, but most Costa Rican species make them in protected areas such as under rock overhangs.

KEY TO COSTA RICAN *MYRMELEON*

1. Forewing with costal area greatly expanded at pterostigma, (over twice as broad as above radial sector), and with several crossveins basad to pterostigma interconnected (Fig. 617) (subgenus *Neohornius* Navás) . *M.(N.) perspicuus*

1′. Forewing with costal area not greatly expanded at stigma, (at most 1.5 times wider than above radial sector), and without interconnected crossveins (rarely 1, 2) (Fig. 618, 619) (subgenus *Myrmeleon* L.) 2

2(1). Moderate-sized species with body length ranging from 29 to 34 mm; face with broad black band below antennae extending ventrally only to above level of tentorial pits . . . . *M. (M.) uniformis*

2′. Body length 23 to 27 mm; face with broad black band below antennae extending ventrally to below level of tentorial pits . . . . *M. (M.) timidus*

Myrmeleon (*Neohornius*) *perspicuus* Gerstaecker, 1893
(Fig. 617)

DIAGNOSIS. — The broadened forewing costal area near the pterostigma with interconnected crossveins (Fig. 617) distinguishes this species from other *Myrmeleon* in Costa Rica. The body size ranges from about 30 to 35 mm.

GEOGRAPHICAL DISTRIBUTION. — Described from Panama (Chiriquí) and in Costa Rica known from CARTAGO: Santa Teresita de Lajas; Turrialba; HEREDIA: La Selva Biological Station: SAN JOSÉ: San Antonio-Dasimp; Santa Ana.

ALTITUDINAL DISTRIBUTION. — Santa Ana in the Central Valley and Turrialba are both at mid-elevations. La Selva is in the lowlands to the north.

ADULT FLIGHT PERIOD. — July to October.

HABITAT PREFERENCE. — Unknown.

Myrmeleon timidus Gerstaecker, 1888
(Fig. 618)

Diagnosis. — This is the smallest species of *Myrmeleon* in Costa Rica (Fig. 618) with specimens not exceeding 27 mm in body length. This species belongs to the exclusively New World species group of *M. metuendus*, characterized by the development of a sclerotized process ventrally on the male tergite IX. In *M. timidus* this process is black and bilobed.

Geographical Distribution. — Mexico south to northern Chile on the western side of the Andes Mountains. Also found on the Galapagos Islands. In Costa Rica, there are records from GUANACASTE: Santa Rosa National Park; and PUNTARENAS: the beaches at Quepos. This species is probably found throughout most of Costa Rica, wherever the proper habitat is found.

Altitudinal Distribution. — Sea level to at least 400 m.

Adult Flight Period. — December to June.

Habitat Preference. — The pitfall traps are usually made in protected areas, except in very dry areas, where they may be made in the open.

Myrmeleon uniformis Navás, 1920
(Fig. 619)

Diagnosis. — This species is larger (Fig. 619) (body length more than 28 mm) than *M. timidus* (body length less than 27 mm) and tergite IX is not produced ventrally in the male. From *M. perspicuus*, which is about the same size, the lack of interconnected costal crossveins before the pterostigma provides a reliable recognition character.

Geographical Distribution. — Mexico south to Costa Rica. In Costa Rica there are records from PUNTARENAS: Monteverde; and SAN JOSÉ: Escazú.

Altitudinal Distribution. — Monteverde is at about 1500 m elevation, whereas Escazú is a suburb of San José at a somewhat lower elevation in the Central Valley.

Adult Flight Period. — August.

Habitat Preference. — This species constructs its pitfall traps in protected areas such as under rock overhangs and at cave mouths.

Remarks. — Although *Myrmeleon mexicanus* Banks was recorded from Costa Rica by Banks (1914), the specimen probably is *Myrmeleon uniformis* Navás, which is closely related and perhaps a synonym. Substantiated records of *M. mexicanus* are known only from north of the Neovolcanic Plateau of Mexico, those of *M. uniformis* south of the Neovolcanic Plateau with no sympatry known. The name *Myrmeleon leptaleus* Navás, 1924 that was previously recorded from Costa Rica is a **new synonym** of *Myrmeleon uniformis.*

Tribe Nemoleontini

This is the largest tribe in the family both in numbers of genera and species. The wing venation distinguishes this tribe from others found in Central America. The hind wing radial sector arises close to the wing base and there is only one presectoral crossvein. The forewing vein 2A runs along 3A for a short distance before angling abruptly toward the hind margin. This condition is also found in the Myrmeleontini. There are five genera recorded from Costa Rica. *Dimarella* Banks is the most distinctive because the male ectoproct has an elongate postventral lobe (absent in other genera of this tribe), the antennal scrobe is widely separated from the eye, and the pretarsal claws are modified to close against the ventral surface of the distal tarsomere (found also in *Elachyleon,* Fig. 648). *Glenurus* Hagen contains species with considerable wing markings (Fig. 629–631). Its larvae are very distinctive in having only two mandibular teeth. *Eremoleon* Banks contains two species in which the larvae live in cave mouths or rock overhangs. The larvae of *Purenleon* Banks live in sand. The fifth genus, *Elachyleon* Esben-Petersen, is unknown as to larval habitat and appears to be relatively rare.

Dimarella Banks, 1913

This genus was recently revised by Miller and Stange (1989) and contains three species found in Costa Rica. The larvae live in sand and resemble those of *Purenleon*. The adults are very distinctive in having the antennal bases far removed from the eye (by more than width of antennal scrobe), having an elongate postventral lobe developed from the male ectoproct, and in having the pretarsal claws modified to close upon the ventral surface of the distal tarsomere.

KEY TO COSTA RICAN *DIMARELLA*

1. Forewing vein CuP+1A reaching hind margin near level of origin of radial sector; forewing posterior area with one series of cells and narrower than cubital area at level of radial sector (Fig. 655) . . . . *D. mixteca*
1′. Forewing vein CuP+1A reaching hind margin well beyond level of the origin of the radial sector; forewing posterior area with two series of cells and wider than cubital area at origin of radial sector (Figs. 649, 652) 2

2(1′). Forefemur cylindrical, at least nine times longer than wide (Fig. 650) . . . . *D. angusta*
2′. Forefemur greatly swollen, about five times longer than wide (Fig. 653) . . . . *D. garciai*

Dimarella angusta (Banks, 1908)
(Figs. 649–651)

DIAGNOSIS. — This species has body length between 20 to 25 mm and the many antennal flagellomeres are longer than wide (Fig. 651). The forefemur is about nine times longer than wide, which separates it from *D. garciai* which has similar broad wing venation. From *D. mixteca*, the wing venation (Fig. 649) is distinctive.

GEOGRAPHICAL DISTRIBUTION. — Described from Ecuador, widespread in South America (Colombia, Venezuela, Brazil, Peru, Bolivia) and known from Panama and Costa Rica. Records from Costa Rica are from HEREDIA: La Selva Biological Station, 3 km S Puerto Viejo; LIMÓN: Río Reventazon; and PUNTARENAS: Boca de Barranca.

ALTITUDINAL DISTRIBUTION. — Mid-elevations.

ADULT FLIGHT PERIOD. — March to June.

HABITAT PREFERENCE. — Unknown.

Dimarella garciai (Navás, 1932)
(Figs. 652–654)

DIAGNOSIS. — The greatly swollen forefemur (Fig. 653), which is about five times longer than greatest diameter, is distinctive among Costa Rican species. Also, the mesoscutum lacks the prominent white bristles found in other species of *Dimarella* in Costa Rica. The size of this species is about the same as *D. angusta*.

GEOGRAPHICAL DISTRIBUTION. — Known from Ecuador, Costa Rica, and Panama. The only locality for this species in Costa Rica is GUANACASTE: Santa Rosa National Park.

ALTITUDINAL DISTRIBUTION. — 300 m.

ADULT FLIGHT PERIOD. — December.

HABITAT PREFERENCE. — Unknown.

Dimarella mixteca Miller, 1989
(Figs. 655–657)

DIAGNOSIS. — The body length of this species averages a little smaller (21 mm) than other species in Costa Rica. It belongs to a species group centered in Mexico and has distinctive wing venation among Costa Rican species. The forewing vein CuP+1A is short and reaches the hind margin at about the level of the origini of the radial sector. Also, the forewing posterior area is very narrow and contains only one series of cells (Fig. 655).

GEOGRAPHICAL DISTRIBUTION. — Mexico, Honduras, and Costa Rica.

ALTITUDINAL DISTRIBUTION. — Unknown.

ADULT FLIGHT PERIOD. — Unknown.

HABITAT PREFERENCE. — Unknown.

Elachyleon Esben-Petersen, 1927

This is a poorly known genus probably closely related to *Eremoleon*. The larval habitat for species of this genus has not been discovered. The species have elongate legs and the pretarsal claws are modified to fold against the specialized setal patch on the ventral side of the distal tarsomere. This condition is found elsewhere in Costa Rica only in the genus *Dimarella*. There are two described species in the genus, the type species, *Elachyleon punctipennis*, which ranges from Mexico to Argentina, and *Elachyleon gentilis* (Banks) known only from Guyana.

Elachyleon punctipennis Esben-Petersen, 1927
(Figs. 610, 646–648)

DIAGNOSIS. — This species has a bright yellow pronotum and is about 20 mm in body length. The legs are very long (Fig. 648) and the pretarsal claws can fold against a specialized setal patch on the ventral side of the distal tarsomere (Fig. 648). The setae in the setal patch are hooked apically (in contrast to those found in *Dimarella*).

GEOGRAPHICAL DISTRIBUTION. — Mexico south to Argentina. The type was described from Trinidad, but a more prominently marked subspecies (wings, Figs. 610, 646) was described from LIMÓN: Las Mercedes, Costa Rica. Other records from Costa Rica are GUANACASTE: Parque Nacional Guanacaste; and HEREDIA: 12 km S Puerto Viejo.

ALTITUDINAL DISTRIBUTION. — 500 m (Puerto Viejo).

ADULT FLIGHT PERIOD. — April, July, and September in Costa Rica.

HABITAT PREFERENCE. — Unknown.

REMARKS. — *Elachyleon punctipennis pulchellus* Esben-Petersen, 1932 is **a new synonym** of *Elachyleon punctipennis*.

Eremoleon Banks, 1901

This New World genus contains 17 described species, but probably at least that many more species await description. The larvae live under rock overhangs or in cave mouths, usually anchored on bedrock with fine dust covering them. The species have elongate legs similar to *Elachyleon* and *Glenurus*, but do not have the pretarsal claws modified to fold against the distal tarsomere. Species of *Glenurus* have more prominent wing markings and have the posterior gonapophysis of the female terminalia greatly reduced in size. Two species of *Eremoleon* found in Costa Rica have the forewing costal area biareolate, which is uncommon in this genus. It is likely that further species of *Eremoleon* will be found in Costa Rica when a search for larvae in caves and rock overhang habitats is done.

KEY TO COSTA RICAN *EREMOLEON*

1. Forewing with a prominent arched line originating near hind border and vein Cu (Fig. 636) . . . . *E. genini*
1′. Forewing without prominent arched line (Fig. 633) . . . . *E. dunklei*

Eremoleon dunklei Stange, 1999
(Figs. 632–635)

DIAGNOSIS. — Greatest ocular width about equal to greatest interocular distance (Fig. 634); forewing without prominent sinuate line (Fig. 633).

GEOGRAPHICAL DISTRIBUTION. — Costa Rica, known only from the holotype collected at PUNTARENAS: Monteverde.

ALTITUDINAL DISTRIBUTION. — 1400 m.

ADULT FLIGHT PERIOD. — Late February.

HABITAT PREFERENCE. — Unknown.

***Eremoleon genini* (Navás, 1924)**
(Figs. 636–637)

DIAGNOSIS. — Greatest ocular width much less than greatest interocular distance; forewing with prominent sinuate line (Fig. 636).

GEOGRAPHICAL DISTRIBUTION. — Mexico and Costa Rica: SAN JOSÉ.

ALTITUDINAL DISTRIBUTION. — Elevation about 1000 m.

ADULT FLIGHT PERIOD. — Unknown.

HABITAT PREFERENCE. — Unknown.

Glenurus Hagen 1866

This is a uniform genus easily recognized in Costa Rica by the considerable brown suffusion of the hind wing and usually forewing apical field. This color pattern evidently offers camouflage as the adults fly in and out of the shadows in shaded woods. However, it is apparent that the adults are noctural as they are attracted to lights, often after midnight. The larvae are unique in the New World in having only two mandibular teeth. They live usually in association with wood, either in dry tree holes or wood debris in decaying logs. They are slow moving and burrowing except for the faster *Glenurus proi* which lives on top of loose, rain-protected soil. The genus has eight described species ranging from the southeastern United States south to Argentina, with two species recorded from Costa Rica and a third likely occurring there.

KEY TO COSTA RICAN *GLENURUS*

1. Pterothoracic pleura sharply divided into dark brown band above and pale brown band below (book cover) . *G. proi*
1′. Pterothoracic pleura not divided into dark brown and pale brown bands 2

2(1′). Hind basitarsus longer than distal tarsomere; forewing without the prominent brown suffusion in the apical field that is found in the hind wing (Fig. 629) . . . . *G. heteropteryx*
2′. Hind basitarsus shorter than distal tarsomere; forewing with prominent brown suffusion in apical field similar to that found in hind wing (Fig. 630) . . . . *G. luniger*

Glenurus heteropteryx Gerstaecker, 1885
(Fig. 629)

DIAGNOSIS. — Easily distinguished from other species of *Glenurus* by the lack of the prominent brown suffusion in the forewing (Fig. 629). The hind basitarsus is longer than the distal tarsomere, which is also found in *Glenurus proi*.

GEOGRAPHICAL DISTRIBUTION. — Described from Panama and Trinidad. Also found in Venezuela and Ecuador. Very likely to be found in Costa Rica.

ALTITUDINAL DISTRIBUTION. — Unknown.

ADULT FLIGHT PERIOD. — Unknown.

HABITAT PREFERENCE. — Unknown.

Glenurus luniger Gerstaecker, 1893
(Fig. 630)

DIAGNOSIS. — The nearly solid brown band from the pterostigma to the hind margin in the forewing (Fig. 630) is distinctive from *G. heteropteryx* (lacks the band) and *G. proi* (has the band broken up ventrally). The short basitarsus, which is shorter than the distal tarsomere, provides a good character to separate this species from other Costa Rican species.

GEOGRAPHICAL DISTRIBUTION. — Ranges from southwestern U.S.A. (Arizona and California) south to Panama.

ALTITUDINAL DISTRIBUTION. — Unknown.

ADULT FLIGHT PERIOD. — Unknown.

HABITAT PREFERENCE. — The larvae of this species have been found living in wood debris associated with dry tree holes and also in leaf litter under rock overhangs.

Glenurus proi Navás, 1929
(cover, Fig. 631)

DIAGNOSIS. — The sharp color division of the pterothoracic pleura into a dark brown band above and pale brown below is distinctive for this species (book cover). The hind basitarsus is longer than the distal tarsomere, as is also found in *G. heteropteryx*, which lacks the prominent dark brown stripe in the apical field. In *G. proi*, this band is not solid as in *G. luniger* and there are pale spots near the ventral margin of the band.

GEOGRAPHICAL DISTRIBUTION. — Described from Mexico but has also been collected in Costa Rica: GUANACASTE: Santa Rosa National Park.

ALTITUDINAL DISTRIBUTION. — About 300 m.

ADULT FLIGHT PERIOD. — March and December in Costa Rica.

HABITAT PREFERENCE. — Larvae of this species were found living on top of the soil under a large, ground-level, tree root overhang in Mexico. Nearby was a rodent burrow, which is significant since it is believed that ovipositing females are attracted by the odor of animal feces. The larvae are highly unusual in that they cover themselves with debris, including rodent pellets, and proved to be relatively active predators compared to other known larvae of *Glenurus*.

Purenleon Stange, new genus

TYPE SPECIES. — *Purenleon abruptus* Stange, new species, by present designation.

= *Diazus* Navás 1914:220 (preoccupied by *Diazus* Le Conte, 1859, Scarabaeidae: Coleoptera), by original designation. **New synonymy.**

TYPE SPECIES. — *Diazus clavatus* Navás, by monotypy.

DIAGNOSIS. — Differs from the majority of genera of the tribe Nemoleontini by the stout legs with the forefemur swollen. Also, the tibial spurs are present, the pretarsal claws are not capable of closing against the distal tarsomere and there is no postventral lobe developed from the male ectoproct.

DESCRIPTION. — Antennal fossa separated from ocular rim by much less than the greatest diameter of scape; pronotum wider than long; mesoscutellum smaller than metanotum; legs about equal in length, hind leg sometimes longer than foreleg; tibial spurs present; basitarsus of hind leg at least 2.5 times longer than greatest width, longer than pretarsal claws; pretarsal claws not capable of closing against distal tarsomere; forewing with anterior margin evenly curved toward apex, costal area at point of coalescing of subcostal and radial veins lower than at middle of wing; forewing radial sector originates well beyond forking of CuA; posterior fork of forewing vein CuA at an oblique angle to hind margin; forewing vein 2A widely separated from normal 3A before strongly angling toward posterior margin; hind wing vein CuA extends to, or sometimes well beyond, forking of MP_2; male ectoproct simple without postventral lobe; male paramere in form of rigid plate; male gonarcus not greatly expanded laterally; female tergite VIII without well-developed subapical row of long, stout setae; female ectoproct without digging setae; posterior gonapophysis well developed, often somewhat inflated.

Included species: *Purenleon abruptus* Stange, *P. albovaria* (Banks) **[new combination]**, *P. bistictus* (Hagen) **[new combination]**, *P. clavatus* (Navás) **[new combination]**, *P. connexus* (Banks) **[new combination]**, *P. cubensis* (Alayo) **[new combination]**, *P. debilis* (Gerstaecker) **[new combination]**, *P. imbellis* (Banks) **[new combination]**, *P. iniquus* (Navás) **[new combination]**, *P. inscriptus* (Hagen) **[new combination]**, *P. minor* (Banks) **[new combination]**, *P. nubipennis* (Navás) **[new combination]**, *P. parallelus* (Banks) **[new combination]**, *P. reductus* (Banks) **[new combination]** and *P. zayasi* (Alayo) **[new combination]**.

OBSERVATIONS. — The type species of the genus *Psammoleon* are now placed in the genus *Euptilon* Westwood, a genus misinterpreted by later workers. The holotype of the type species of *Euptilon* is apparently missing and the colored figure of the type species shows a composite insect with antlion wings and body, but with the attached antennae of a corydalid. The green color of the body is misleading since this color is absent in the Myrmeleontidae. Evidently the insect had some green mold or perhaps green discoloration of the pin. The wings are clearly those of what has been called *Psammoleon guttipes* Banks, which is now considered a synonym of *Psammoleon ornatus*. This is especially evident from the type locality of *Hemerobius ornatus* which is Dinwiddie, Virginia. No other insect from this area can be confused with *Psammoleon ornatus*. *Psammoleon arizonensis* Banks, *P. decipiens* Banks, *P. ornatus* (Drury) (= *P. guttipes* Banks) and *P. sinuatus* Currie now constitute the genus *Euptilon*. Many of the species here included in *Purenleon* formerly were placed in *Psammoleon*. However, the species *Psammoleon bipunctatus* Navás, *Psammoleon cautus* (Walker), and *Psammoleon nebulosus* (Navás) are not closely related to *Euptilon* or *Purenleon* and are here transferred to the genus *Dimarella* Banks until their relationships can be more closely studied. They agree with *Dimarella* in having a well-developed postventral lobe on the ectoproct and similar male genitalia, but the head is not modified as in *Dimarella*. *Dimarella* appears to be centered in Mexico, Central America and the Caribbean Islands.

Although records of only two species of *Purenleon* are known from Costa Rica, there are certainly other species, especially *P. parallelus* and *P. debilis* which are known from Mexico and Panama. Probably there are other species as well, since no good antlion survey has been made for Costa Rica. The larvae live in sand. The adults are easily distinguished from other groups in Costa Rica by the stout legs and the elongate forefemoral sense hair, which is over one-half the length of the femur. The forefemur is swollen, at its widest point being much wider than interantennal distance, and has abundant pubescence, especially on the closing face.

KEY TO COSTA RICAN *PURENLEON*

1. Pretarsal claws of foreleg ≤ one-half length of basitarsus; forewing costal area abruptly broadened near base (Fig. 638); forewing length less than 20 mm . . . . *P. abruptus*
1′. Pretarsal claws of foreleg ≥ length of basitarsus; forewing costal area not abruptly widened near base; forewing length more than 22 mm 2

2(1′). Vein CuP+1A of forewing running parallel to posterior fork of CuA for a long distance beyond origin of radial sector; mesofemoral sense hair about one-half length of profemoral sense hair . . . . *P. parallelus*
2′. Vein CuP+1A of forewing running obliquely to hind margin along posterior fork of CuA at a point near origin of radial sector (Fig. 639, 640); mesofemoral sense hair as long as profemoral sense hair 3

3(2′). Hind leg pretarsal claws much longer than basitarsus; hind wing much broader at about 3/4 distance from base than basally or distally (Fig. 640) . . . . *P. iniquus*
3′. Hind leg pretarsal claws shorter than basitarsus; hind wing not especially broadened toward apex (Fig. 639) *P. debilis*

***Purenleon abruptus* Stange, new species**
(Figs. 638, 642)

HOLOTYPE. — Male, 37.1 km (23 mi) south Matias Romero, Oaxaca, Mexico, IV.5.1962, L. Stange collector (Florida State Collection of Arthropods).

DIAGNOSIS. — This species is distinctive in having the forewing costal area abruptly broadened near the base. Mid-femoral sense hair about one-half as long as that of forefemur, about one-fourth length of femur. The relatively small pretarsal claws, which are not more than one-half as long as the basitarsus of the foreleg, is a diagnostic character in Costa Rica.

DESCRIPTION. — Length of body from vertex to apex of abdomen 17 mm, length of forewing and hind wing 20 mm.**General coloration**: Light brown, forewing with dark brown on crossveins where posterior fork of cubital fork meets posterior margin and at rhegma. Face pale brown with broad dark brown band above and below antennae, emarginate ventrally at middle; vertex (Fig. 642) mostly grey, pruinose with nearly black scars; mouthparts pale brown except for dark brown mandibles, stipes and distal palpimere of labium; antenna brown with pale brown at apices of scape and flagellomeres, pedicel nearly all brown; pronotum pale brown with extensive dark brown medially, laterally and anteriorly; mesoscutum mostly dark brown with pale spot on prescutum, irregularly on each side of mesoscutellum which is paler posteriorly, small round pale spot laterally near wing base; metascutum darker with pale brown anteriorly and on posterior margin of metascutellum; thoracic pleura mostly darker brown dorsally, lighter brown ventrally with ventral area mostly dark brown. Coxae and trochanters mostly pale except small basal darkening on coxae; femora mostly pale on closing face, dark brown on exterior face; foretibia mostly dark brown on closing face, mostly pale brown on exterior face with dark brown bands basally, distally and at middle; mid-tibia and hind tibia mostly pale brown on closing face except apically, mostly dark brown on exterior face. Tarsi dark brown except pale brown basitarsus which is darker apically. Abdominal tergites mostly dark brown with pale distal ends, sternites with more pale brown, especially sternites VI to VIII. Ectoproct and sternite IX nearly all light brown. Wing membranes nearly without suffusion, white stigma and minor dark brown suffusion on crossvein near posterior margin where the posterior branch of cubital fork ends, and at rhegma; wing veins and crossveins mostly pale brown but with extensive dark brown coloring producing mostly an alternating pattern of light brown and dark brown.

CHAETOTAXY. — Clypeus, labrum and postmentum with outstanding, mostly white setae, elsewhere on head inconspicuous; setae very short on antennae and mouthparts except distal palpimere of labium with brown setae about as long as width of distal part of palpimere. Pronotum with erect black setae, especially submedially and at posterior margin and three to four elongate white setae sublaterally which are slightly thickened toward apex; rest of nota with few inconspicuous black setae; thoracic pleura with numerous elongate, white setae, some of which are slightly thickened toward apex. Forecoxa with many elongate setae posteriorly that are longer than greatest coxal width and many smaller white setae on lateral surface that are shorter than coxal width; forefemur with many elongate white setae on closing surface, shorter decumbent ones on exterior surface; several elongate, erect black setae on closing surface, several subapically on exterior surface; mid-femur with some white decumbent setae on exterior face and one prominent erect black seta, mesally with many elongate white setae, basal half forming a comb with the setae thickened; hind femur with elongate, erect black setae on distal one-third of exterior face and on middle one-third of closing face; some short white setae on most of femur with a few erect ones on closing face; foretibia with many black erect setae on exterior face and with mostly decumbent white setae, especially on base of exterior face but with few erect white setae on closing face; mid-femur with scattered elongate, erect black setae, some of which are longer than mid-femoral sense hair; hind femur with fewest setae, all black, some short but with many, very long, black setae. Abdomen with predominately short white, semi-decumbent setae except for ectoproct which has elongate, mostly brown, setae. Wings with short setae, none exceeding twice the vein diameter.

STRUCTURE. — Head with vertex slightly raised above eyes; greatest ocular width slightly greater than interocular distance at middle; antenna moderately long and weakly clavate, with 36 flagellomeres, basal flagellomeres about twice as long as wide, others broader than long; distal palpimere of labium moderately swollen with long narrow apex, palpimacula oval, situated about midway; pronotum a little wider than long. Legs similar in length, foreleg shorter than midleg which is shorter than hind leg; forefemur swollen, femoral sense hair long, about half as long as forefemoral length; foretibia and mid-tibia swollen irregularly, slightly narrower at middle; mid-femoral sense hair about one-half as long as that of forefemur, about one-fourth length of femur; basitarsus of foreleg about 3.5 times longer than middle diameter, shorter than distal tarsomere; basitarsus of midleg about 4.0 times longer than middle diameter, and that of hind leg about 6 times longer than middle diameter, longer than distal tarsomere; tibial spurs of foreleg and midleg reaching to about apex of second tarsomere, that of hind leg to apex of basitarsus; pretarsal claws short, about as long as tarsomere II of hind leg. Forewing the same length as hind wing; forewing costal area (Fig. 638) abruptly broadened at base, costal cells not interconnected by crossveins, those above radial sector about 1.5 times as high as wide. Abdomen much shorter than forewing length; male ectoproct simple, not produced.

FEMALE. — Similar to the male except for terminalia. Pregenitale well developed; posterior gonapophysis about four times longer than middle diameter with many elongate setae, some of which are subequal in length to gonapophysis; lateral gonapophysis without digging setae, usually well concealed in genital complex; ectoproct strongly produced ventrally with row of about four elongate black setae ventrally, elsewhere many other setae which are finer.

VARIATION. — The length of the forewing varies from about 18 to 25 mm. Forewing rhegmal area more prominently marked in some specimens.

PARATYPES (16 males, 4 females). — 1 male, 1 female, Santa Rosa National Park, Guanacaste Prov., COSTA RICA, 300 m, March 1984, D. H. Janzen and W. Hallwachs (INBIO, Costa Rica);); 1 male, Rabinal, Baja Verapaz, GUATEMALA, II.7.1965, G. S. O'Neal (FSCA); 1 female, train 64.5 km (40 mi) E Guatemala City, IV.7.1926, J. M. Aldrich (USNM); 2 males, 1 female, Sierra de Agalta, 8 km. NE Catacamas, Olancho, HONDURAS, 3000', L. Stange and R. Miller (FSCA); same data as holotype (FSCA; Miller collection; USNM); 1 male, 11.3 km (7 mi) NE Tepanatepec, Oaxaca, MEXICO, 4.III.1985, L. Stange and R. Miller (FSCA); 3 males, Chamela, Jalisco, MEXICO, 15/24.IV. 1986, F. Parker (FSCA).

BIOLOGY. — Larvae were found living in loose soil under bark and other debris at the base of a large tree at Matias Romero, Mexico. Four were reared. The duration of pupation varied from 35 to 50 days.

OBSERVATIONS. — This species is very distinctive in having the forewing costal area abruptly broadened near the base. It belongs to the *P. inscriptus* group, which is characterized by relatively small pretarsal claws that are not more than one-half as long as the basitarsus of the foreleg.

GEOGRAPHICAL DISTRIBUTION. — Southern Mexico south to Costa Rica. The only Costa Rican record is: GUANACASTE: Santa Rosa National Park.

ALTITUDINAL DISTRIBUTION. — 300 m.

ADULT FLIGHT PERIOD. — March.

HABITAT PREFERENCE. — See Biology.

Purenleon debilis **(Gerstaecker, 1893) [new combination]**

(Figs. 639, 643)

DIAGNOSIS. — This is a medium-sized antlion (body length 20–28 mm; forewing length 28–31 mm) that is closely related to *Purenleon iniquus*. The pretarsal claws are longer than in that species and the hind wing (Fig. 639) has a different shape.

GEOGRAPHICAL DISTRIBUTION. — Mexico south to Panama. No Costa Rican records are currently known, but it will likely be found there.

ALTITUDINAL DISTRIBUTION. — Mid-elevations.

ADULT FLIGHT PERIOD. — August to November in other Central American countries.

HABITAT PREFERENCE. — Unknown.

Purenleon iniquus **(Navás, 1914) [new combination]**

(Figs. 640, 644)

DIAGNOSIS. — This species is about the same size as *Purenleon debilis* and has a similar basic coloration, although details of the thoracic pattern are paler and more elaborate (Fig. 644). The hind wing shape (Fig. 640) is different from that species. The pretarsal claws are shorter than in *P. debilis*.

GEOGRAPHICAL DISTRIBUTION. — Honduras (holotype) south to Panama. Records from Costa Rica are from Santa Rosa National Park (GUANACASTE) and Caldera.

ALTITUDINAL DISTRIBUTION. — About 400 m.

ADULT FLIGHT PERIOD. — December.

HABITAT PREFERENCE. — The larvae of this species were found living in loose soil around large trees in Honduras.

Purenleon parallelus **(Banks, 1935) [new combination]**

(Figs. 641, 645)

DIAGNOSIS. — The forewing venation is distinctive in that the vein CuP+1A runs parallel to the posterior fork of CuA for a long distance (Fig. 641). This condition is not duplicated in any other described *Purenleon*. The hind wing is shorter than the forewing so that in repose the apices coincide (hind wing longer than forewing in *P. debilis* and *P. iniquus*). Also, the mesofemoral sense hair is only half as long as that of the profemur, which is another distinguishing character from *P. debilis* and *P. iniquus*. This species is smaller than most other Costa Rican *Purenleon* (forewing length 22–24 mm).

GEOGRAPHICAL DISTRIBUTION. — Southern Mexico south to Panama on the Pacific Coast. This species is not currently recorded from, but probably occurs in Costa Rica and should be looked for in coastal sand dune localities.

ALTITUDINAL DISTRIBUTION. — Sea level.

ADULT FLIGHT PERIOD. — March to June.

HABITAT PREFERENCE. — The larvae of this species live in sand dune areas on the coast.

FAMILY POLYSTOECHOTIDAE

by
Norman D. Penny

There are only four extant species of Polystoechotidae known, two species from Chile and two species from North and Central America. The most widespread species, *Polystoechotes punctatus*, is the only species found in Costa Rica.

Polystoechotes punctatus (Fabricius, 1787)

(Fig. 658)

DIAGNOSIS. — This species is a most distinctive neuropteran, being large and broad-winged, with many radial sectors in the forewing (Fig. 658). It does not have the long antennae of ascalaphids, and wings are much broader than antlions.

GEOGRAPHICAL DISTRIBUTION. — The geographical distribution of this species historically included almost all of cool, temperate North America and the high mountain chains of Central America and Mexico as far south as Panama (Penny, unpublished data). In the past half century it appears to have disappeared from much of its former range in temperate North America, including all of the eastern U.S.A. and Canada. Within Costa Rica it has only been collected from Cartago (CARTAGO) and Monteverde (PUNTARENAS).

ALTITUDINAL DISTRIBUTION. — 1500 m at Monteverde.

ADULT FLIGHT PERIOD. — Mid-May to July.

HABITAT PREFERENCE. — In Central America this species appears to be associated with montane forest.

FAMILY SISYRIDAE

by
Norman D. Penny

Spongilla-flies are rather small neuropterans with aquatic larvae that feed on freshwater sponges. Adults usually have a short emergence period. In the central Amazon Region, adult emergence is usually timed to the seasonal rise and fall of rivers and streams, with peak emergence occurring at, or shortly after, the high water period (July). Many species are attracted to lights and can be collected some distance from the nearest stream. Adults superficially resemble brown lacewings (hemerobiids), but have only a single radial sector. The single species presently known from Costa Rica is *Sisyra apicalis*, although others probably occur there.

Sisyra apicalis Banks, 1908

(Figs. 659, 660)

GEOGRAPHICAL DISTRIBUTION. — Originally described from Cuba this species is known from U.S.A. (Gulf Coast) as far south as Panama (Parfin and Gurney 1956) and the Brazilian Amazon (Penny 1981). Within Costa Rica only one collection record is known from: GUANACASTE: 14 km S Cañas.

ALTITUDINAL DISTRIBUTION. — Below 200 m near Cañas.

ADULT FLIGHT PERIOD. — February.

HABITAT PREFERENCE. — Near Cañas this species has been captured at lights near a medium-sized river with patchy forest and open fields surrounding it.

Figures

A list of abbreviations used with the figures is as follows:

1A = first anal vein
2A = second anal vein
3A = third anal vein
a = aedeagus
acu = acumen
arc = arcessus
ax = axillary angle
C = costa
cc = callus cerci
cf = costal field
CuA = anterior cubitus
CuC = cubital cell
CuP = posterior cubitus
d = discal area
dapo = dorsal apodeme
dp = distal process
ect = ectoproct
ent = entoprocessus
f = frenulum
gc = gonarcus
gcr = gonocristae
gcu = gonocornua
gdh = gonarcus dorsal horns
gps = gonapsis
gsc = gonosaccus
gst = gonosetae
h = humeral crossvein
hy = hypandrium
hyt = hypandrium transverse plate
ig = inner gradate series
jl = jugal lobe
la = lateral arm of gonarcus
lp = labial palpus
MA = anterior media
mai = median apical incision of hypandrium
mi = microtholi
mp = maxillary palpus
MP = posterior media
mu = mediuncus
og = outer gradate series
p = penis
pa = parameres
ps = pseudopenis
pt = processes terminales
r-m = radial-medial crossveins
r-r = radial crossveins
R_1 = radius
Rs = radial sector
s = seta
S_{8+9} = eighth + ninth sternites
S_9 = ninth sternite
sap = subanal plate
Sc = subcosta
scf = subcostal field
st = pterostigma
sty = stylus
T_{9+ect} = 9th tergite + ectoproct
ti = tignum
vapo = ventral apodeme

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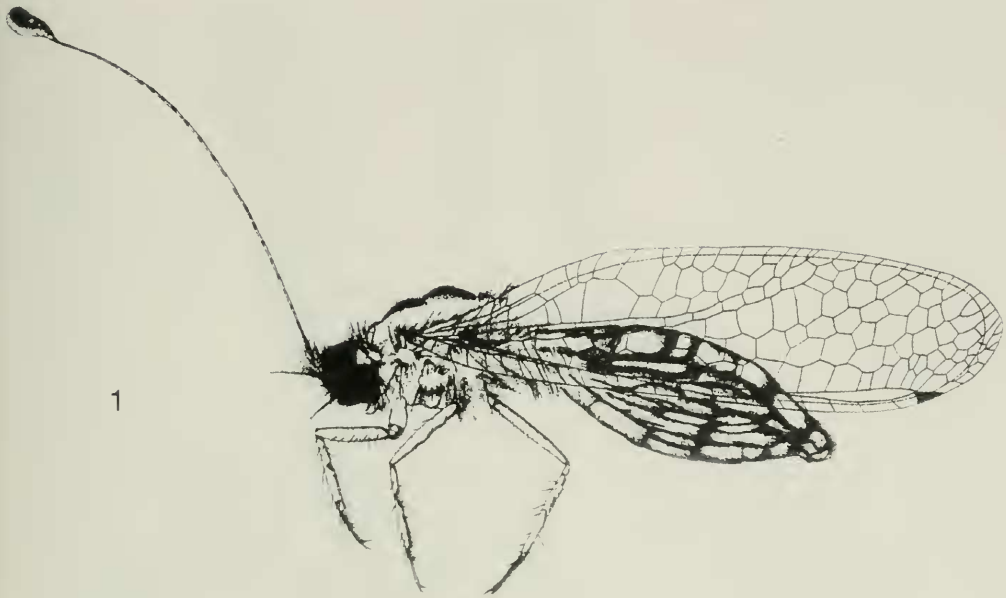

FIGURE 1. *Ululodes macleayana* in habitus view. (Illustration by Artêmio Coelho da Silva)

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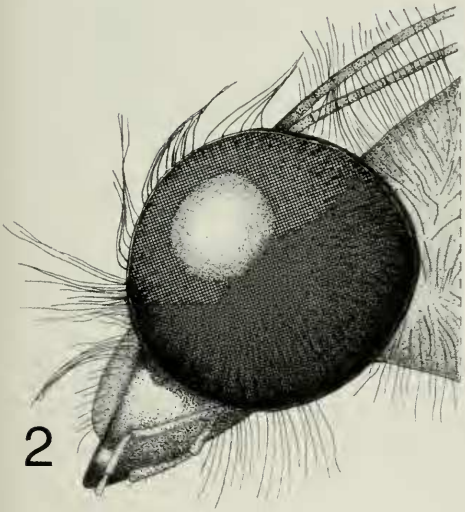

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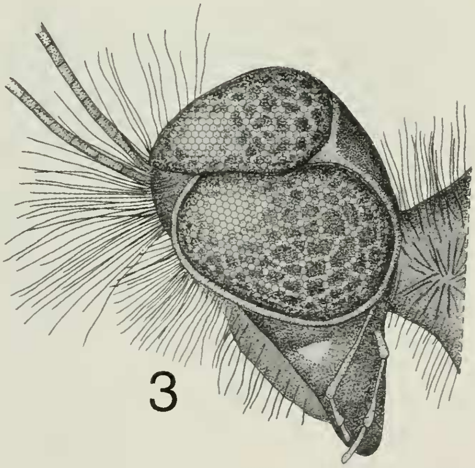

FIGURE 2. *Neohaploglenius flavicornis*, lateral view of head. (Illustration by Victoria Saxe)
FIGURE 3. *Ululodes macleayana*, lateral view of head. (Illustration by Victoria Saxe)

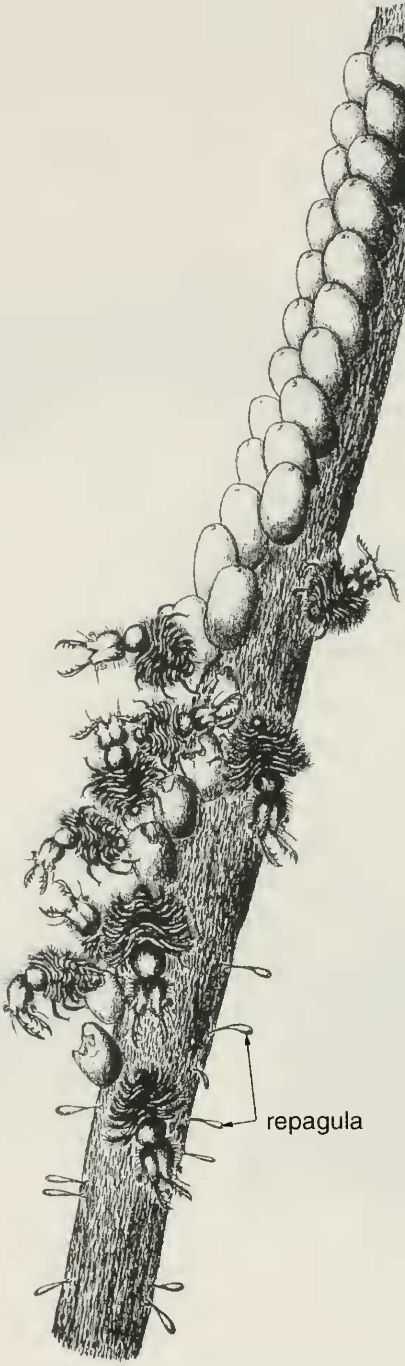

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FIGURE 4. *Ululodes* sp. eggs and larvae. (Illustration by Artêmio Coelho da Silva)

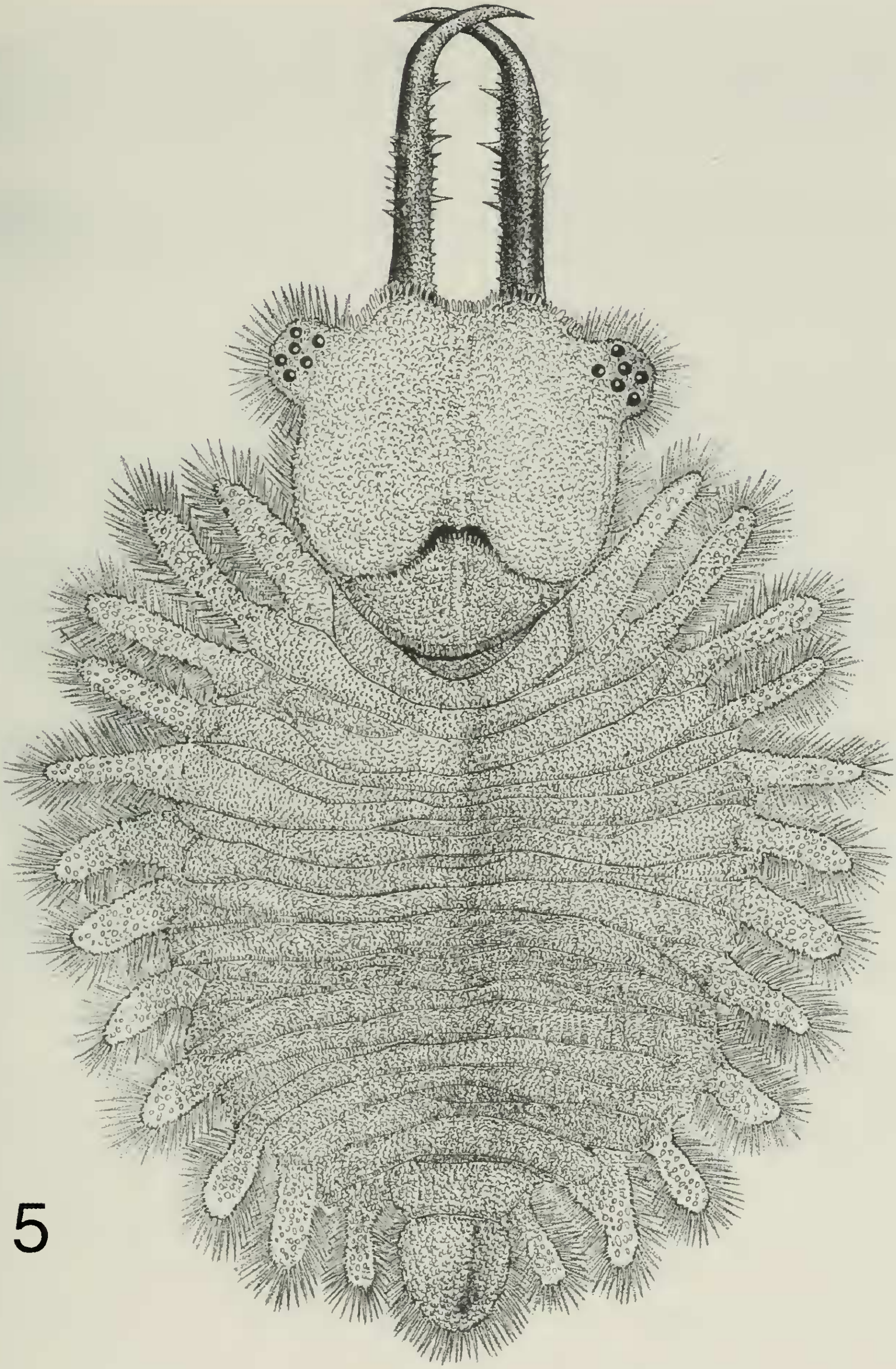

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FIGURE 5. Undetermined Haplogleniinae larva. (Illustration by Alberto Coelho da Silva)

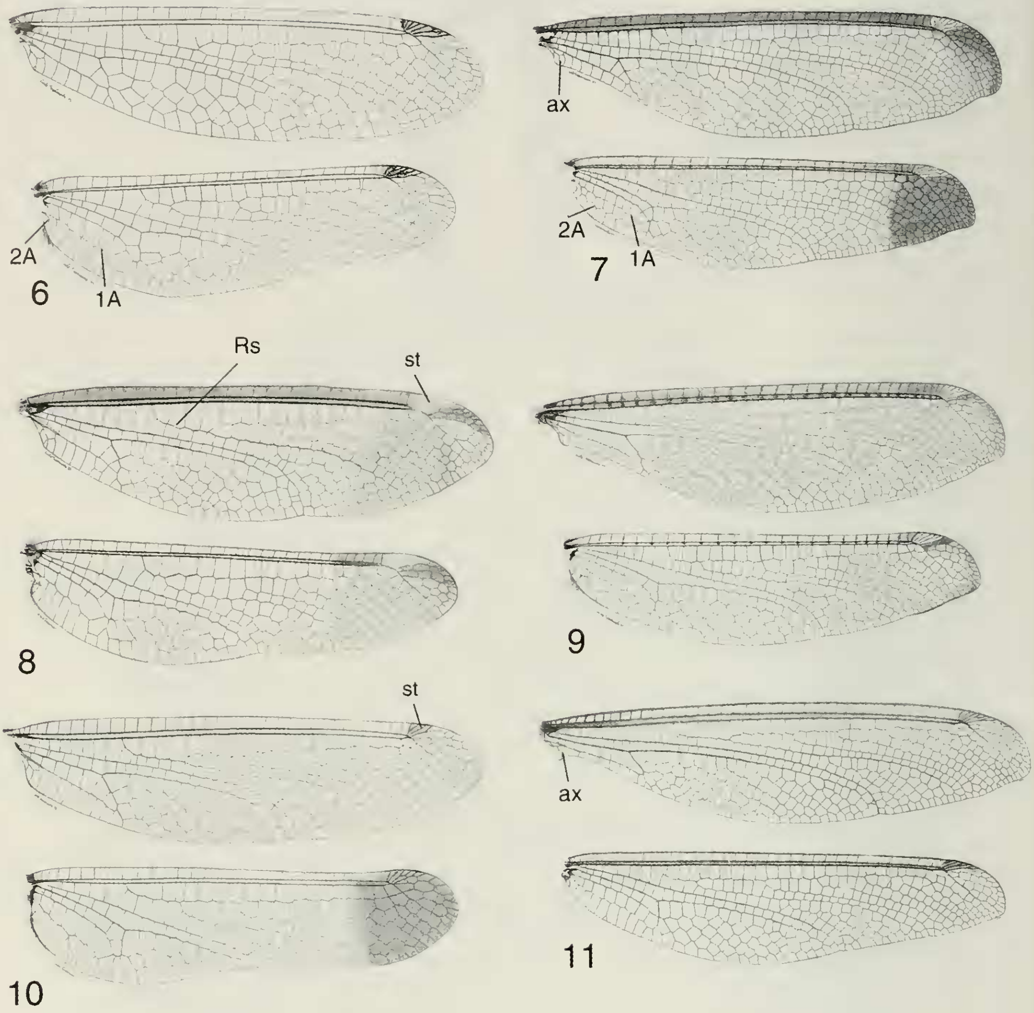
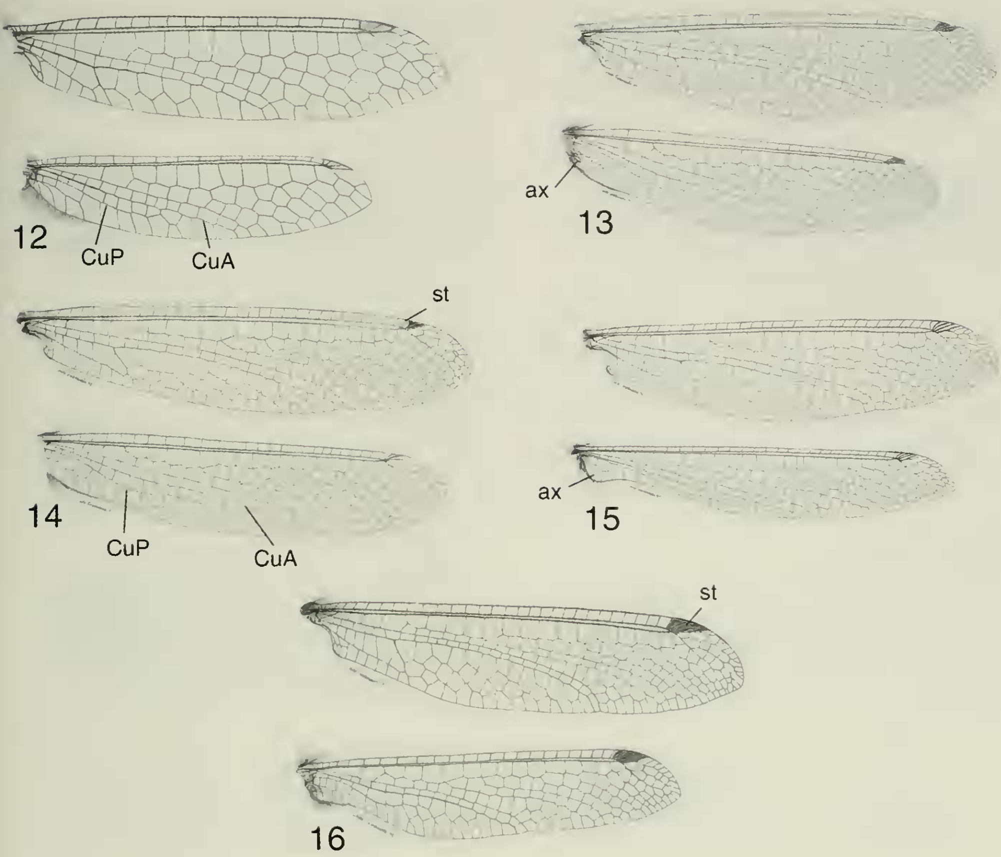
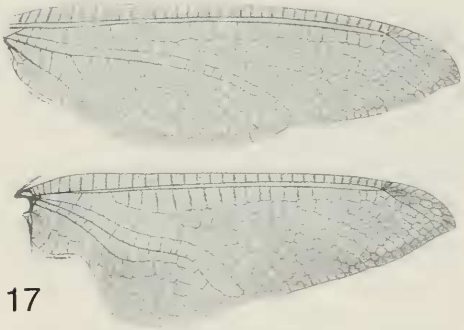


FIGURE 6–11. Right fore- and hindwings of Haplogleniinae. Fig. 6, *Amoea vacuus*; Fig. 7, *Haploglenius luteus*; Fig. 8, *Ascalobyas albistigma*; Fig. 9, *Haploglenius peruvianus*; Fig. 10, *Ascalobyas microcerus*; Fig. 11, *Neohaploglenius flavicornis*. (Illustrations by Linda Seabrooks Campbell)



FIGURES 12–16. Right fore- and hindwings of *Ameropterus*. Fig. 12, *A. breviantennis*; Fig. 13, *A. consors*; Fig. 14, *A. mexicanus*; Fig. 15, *A. subripiens*; Fig. 16, *A. trivialis*. [Illustrations by Jere Schweikert (12) and Linda Seabrooks Campbell (13–16)]



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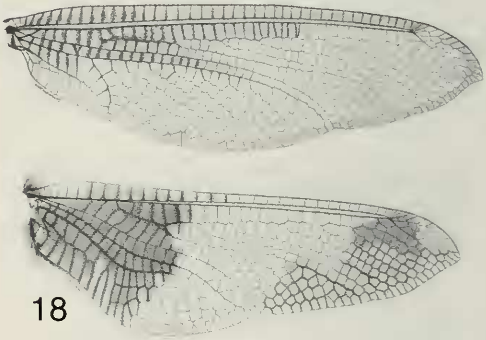

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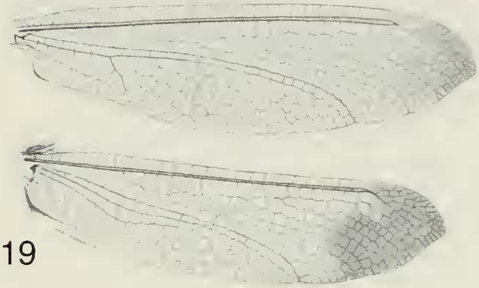

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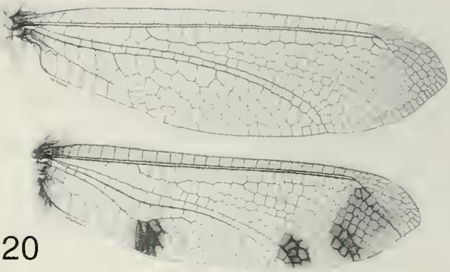

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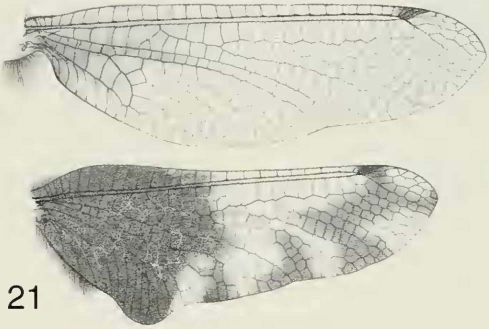

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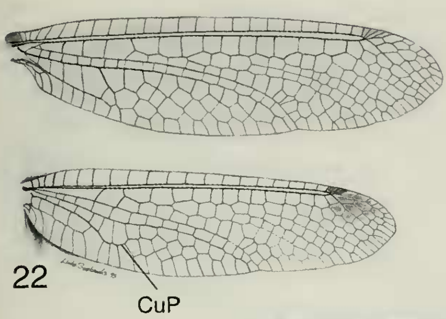
FIGURES 17–21. Right fore- and hindwings of *Cordulecerus*. Fig. 17, *C. inquinatus* (male); Fig. 18, *C. inquinatus* (female); Fig. 19, *C. praecellens* (male); Fig. 20, *C. praecellens* (female); Fig. 21, *C. subiratus*. [Illustrations by Linda Seabrooks Campbell (17–20) and Jere Schweikert (21)]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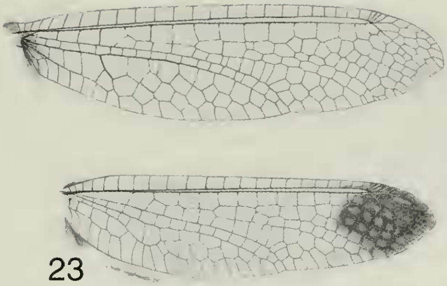
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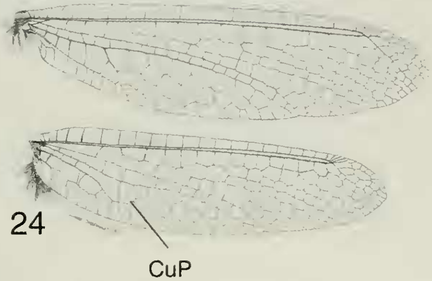
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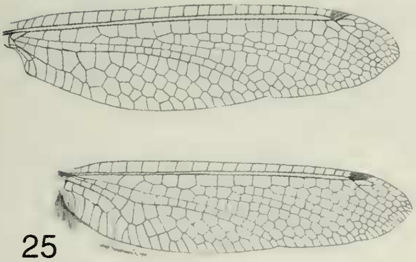
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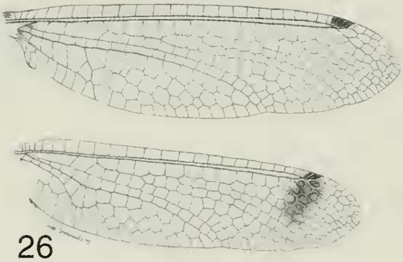
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FIGURES 22–26. Right fore- and hind wings of *Ululodes*. Fig. 22, *U. bicolor* (male); Fig. 23, *U. bicolor* (female); Fig. 24, *U. cajennensis*; Fig. 25, *U. macleayana* (male); Fig. 26, *U. macleayana* (female). (Illustrations by Linda Seabrooks Campbell)

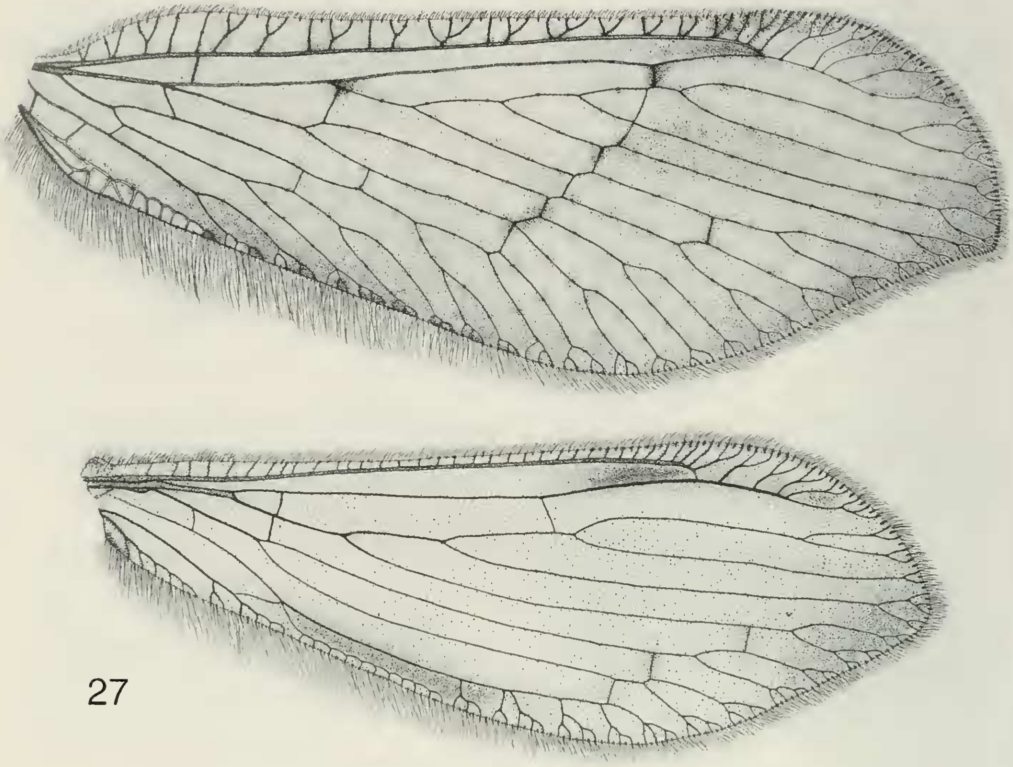

FIGURE 27. *Spiroberotha sanctarosae*, right fore- and hind wings. (Illustration by Jere Schweikert)

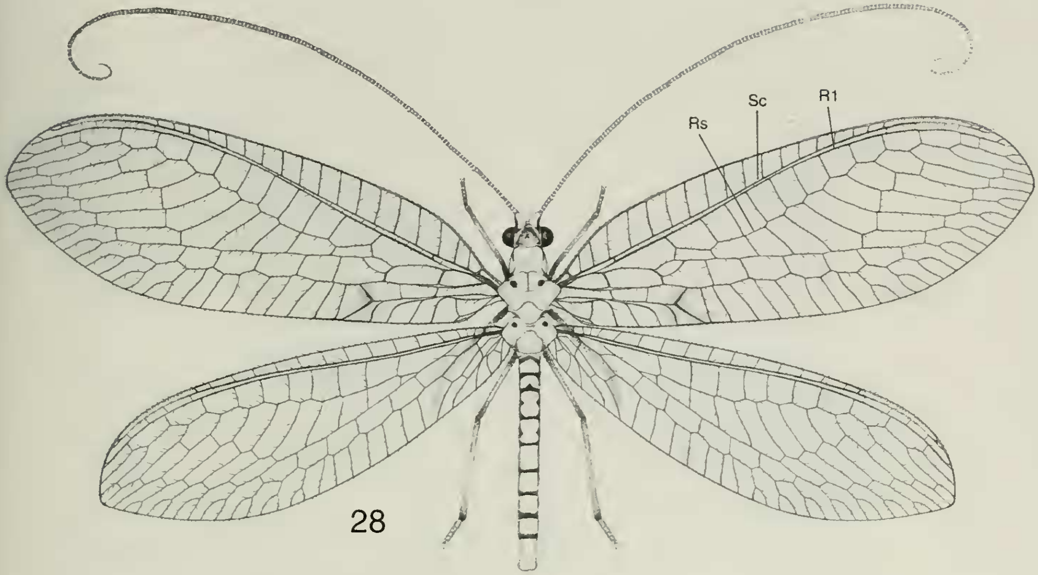

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FIGURE 28. *Ceraeochrysa elegans*, habitus view. (Illustration by Victoria Saxe and Virginia Kirsch)

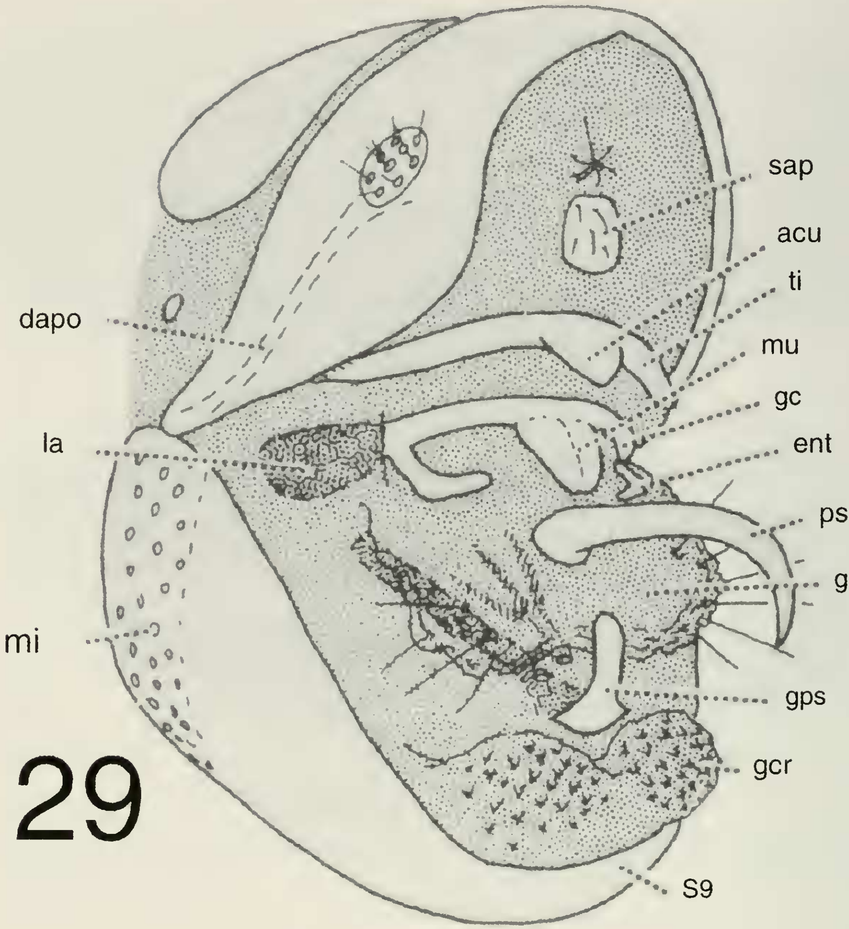
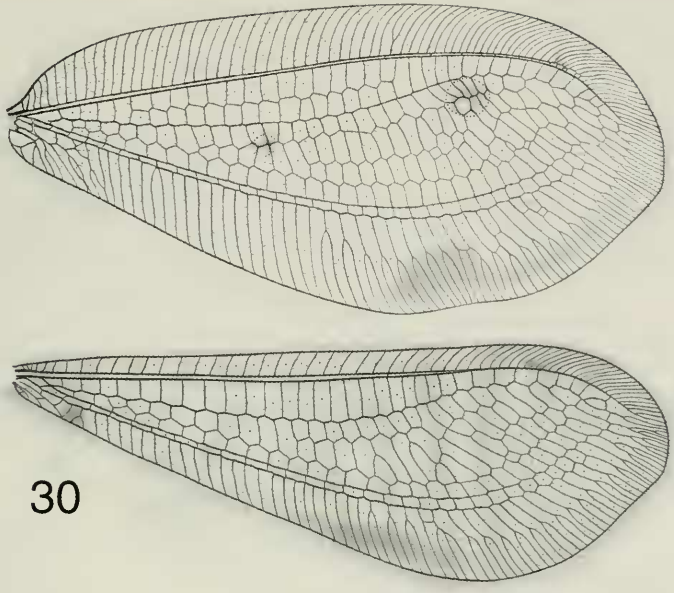


FIGURE 29. Generalized schematic view of a male chrysopid genitalia. 9S = ninth sternite; acu = acumen; ap-ect = dorsal apodeme of ectoproct; ent = entoprocessus; gcr = gonocristae; gp = gonapsis; gs = gonarcus; gsac = gonosaccus; la-gs = lateral arm of gonarcus; mi = microtholi; mu = mediuncus; ps = pseudopenis; sap = subanal plate; ti = tignum. (from Adams and Penny, 1987)



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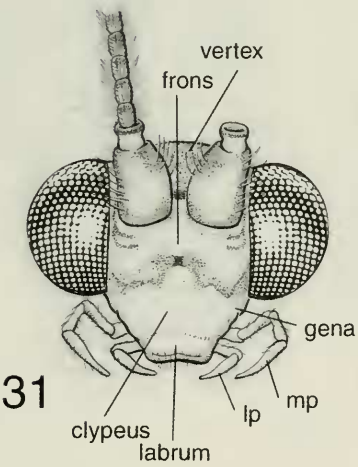

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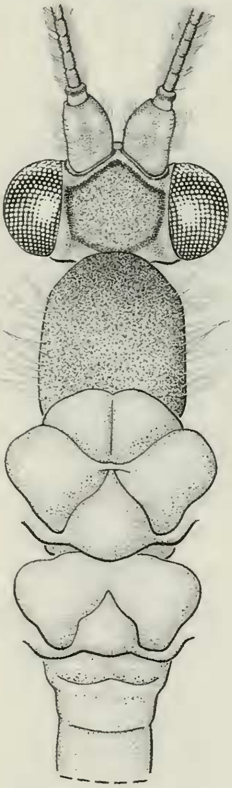

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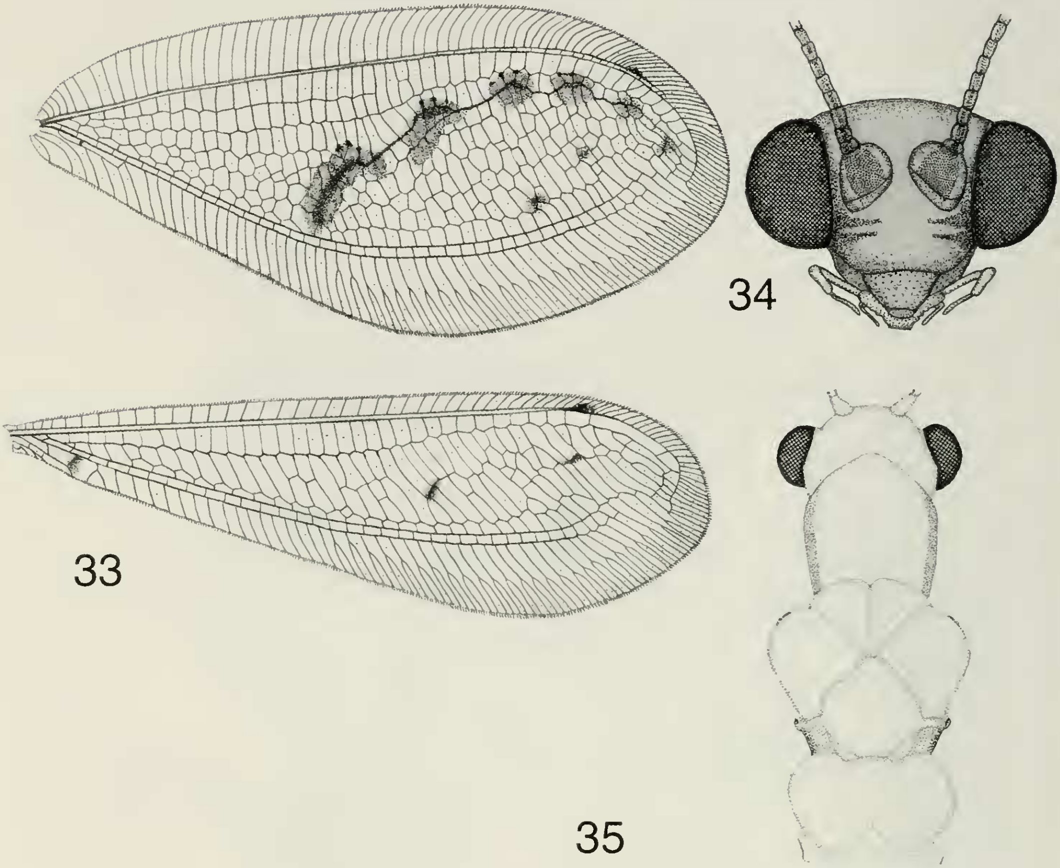
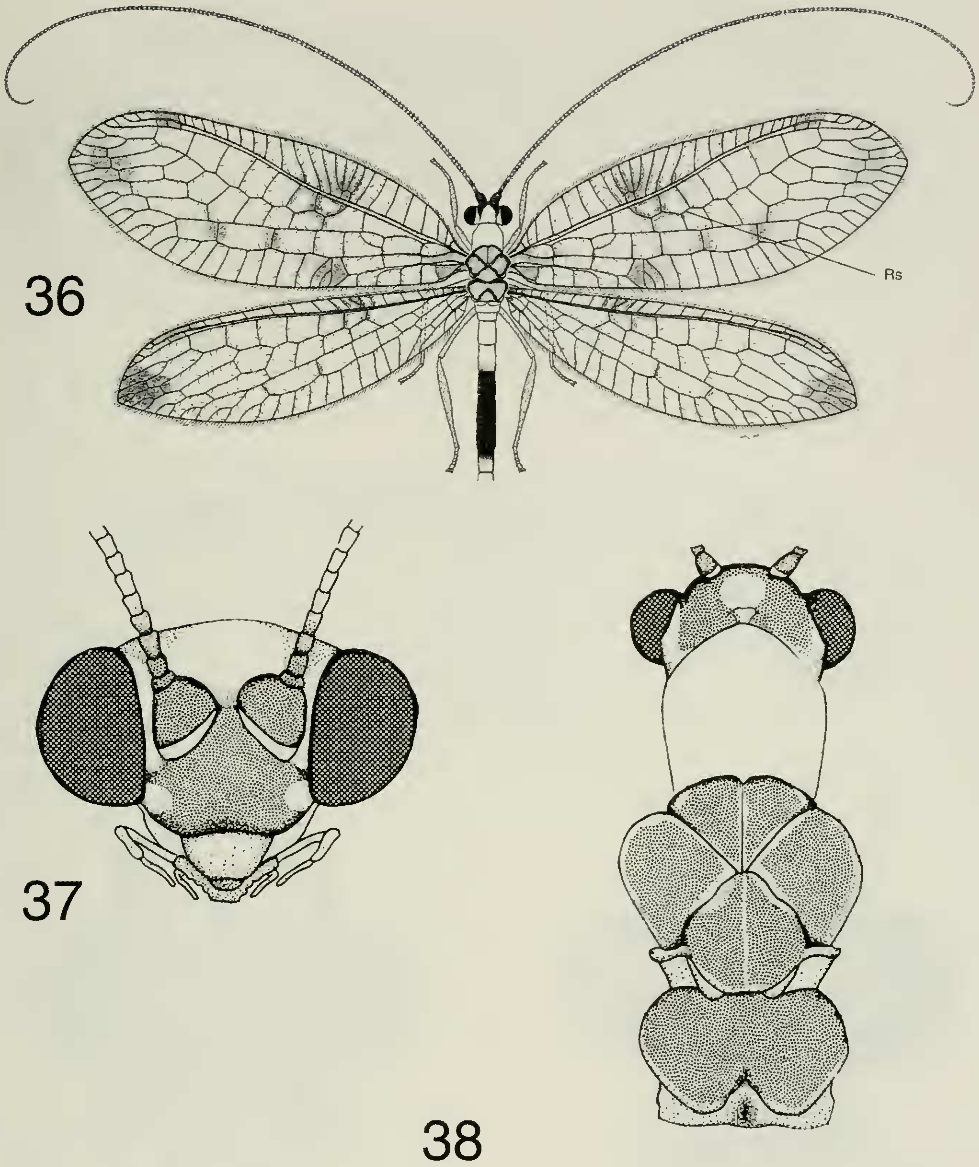
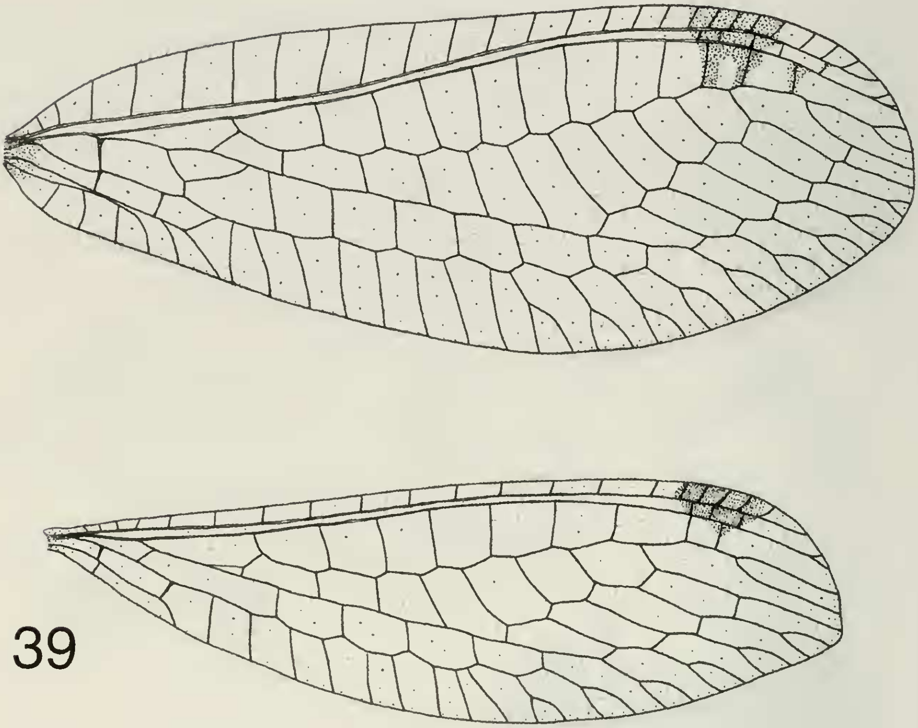
FIGURES 30–32. *Domenechus mirifica* (Gerstaecker). Fig. 30, right fore- and hind wings; Fig. 31, head in frontal view; Fig. 32, head and thorax in dorsal view. (Illustrations by Virginia Kirsch)



Figures 33–35. *Loyola croesus* (Gerstaecker). Fig. 33, right fore- and hind wings; Fig. 34, head in frontal view; Fig. 35, head and thorax in dorsal view. [Illustrations by Fred Ehrman (33, 35) and Diane Wong (34)]



FIGURES 36–38. *Berchmansus elegans* (Guérin-Ménéville). Fig. 36, habitus dorsal view; Fig. 37, head in frontal view; Fig. 38, head and thorax in dorsal view. [Illustrations by Virginia Kirsch (36) and Fred Ehrman (37, 38)]



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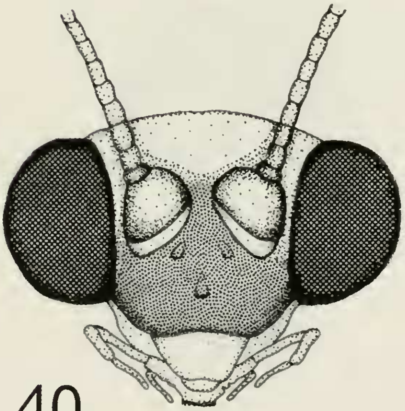

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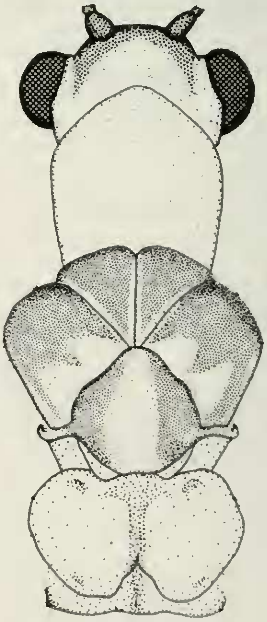

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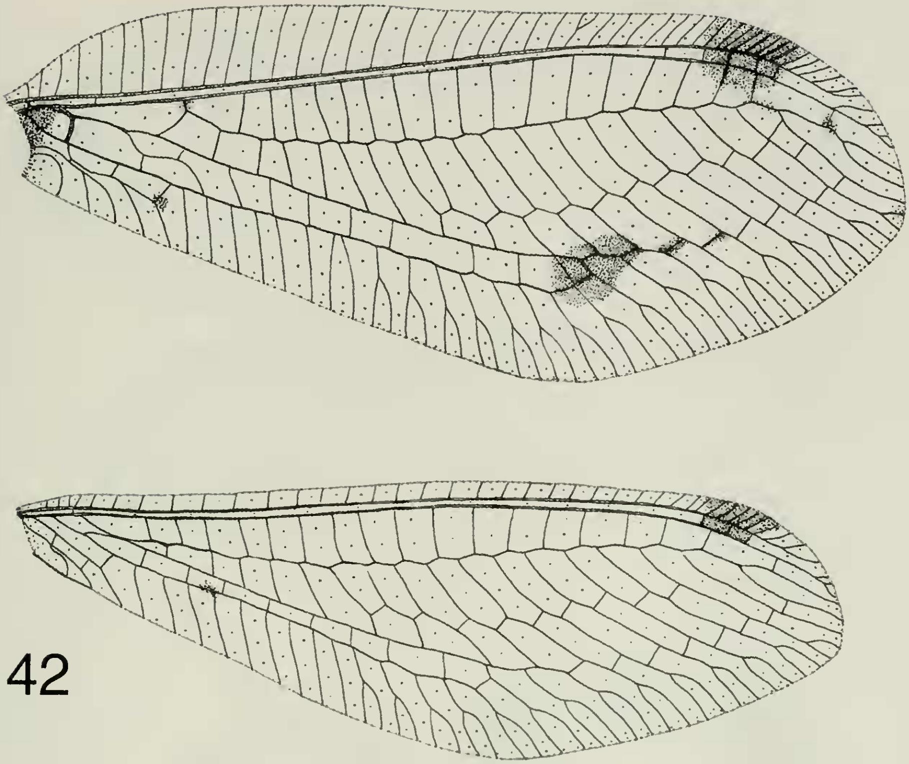
FIGURES 39–41. *Gonzaga palliceps* (McLachlan). Fig. 39, right fore- and hind wings; Fig. 40, head in frontal view; Fig. 41, head and thorax in dorsal view. (Illustrations by Fred Ehrman)



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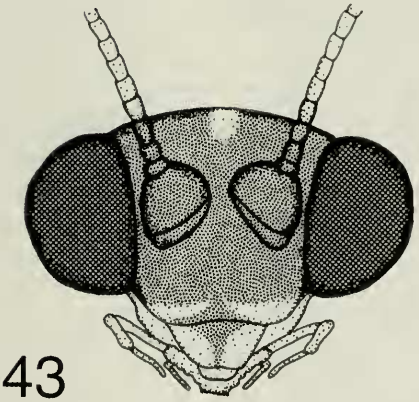

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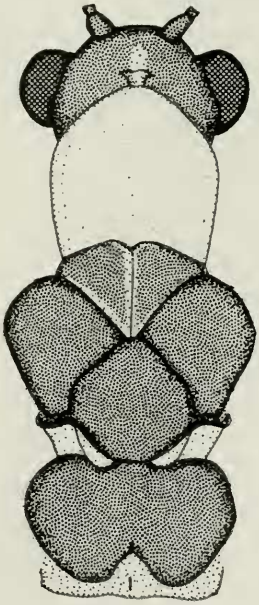

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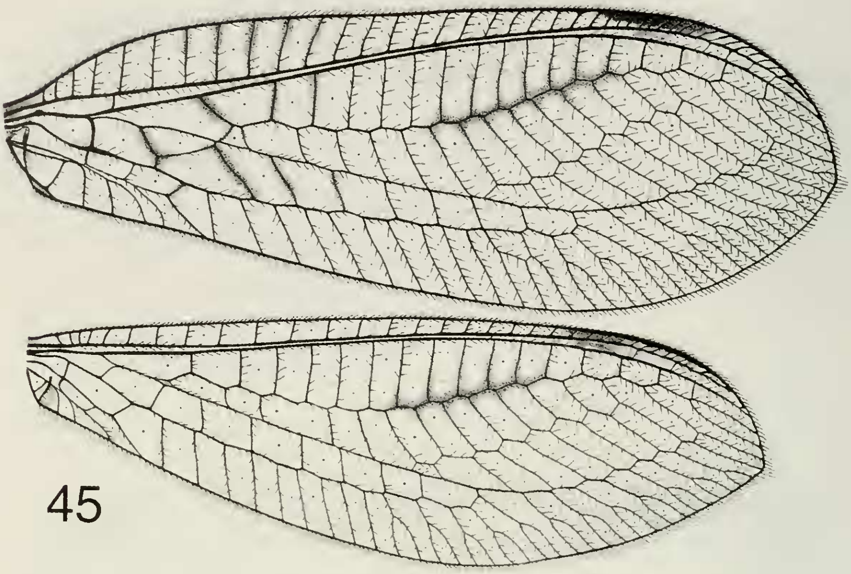
FIGURES 42–44. *Gonzaga torquatus* Navás. Fig. 42, right fore- and hind wings; Fig. 43, head in frontal view; Fig. 44, head and thorax in dorsal view. (Illustrations by Fred Ehrman)



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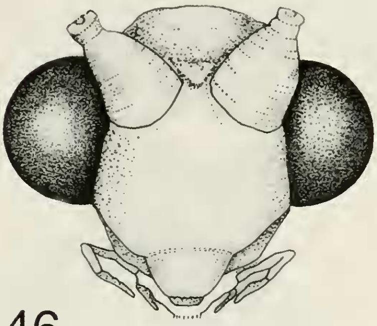

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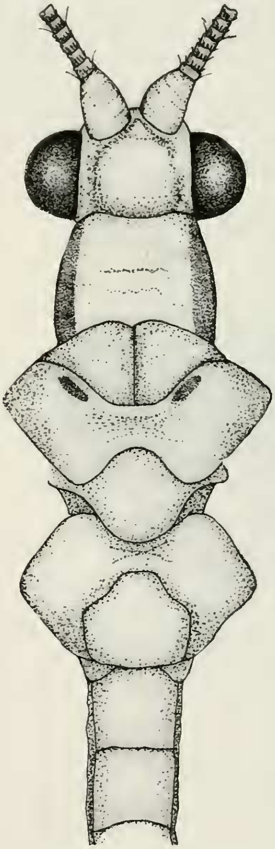

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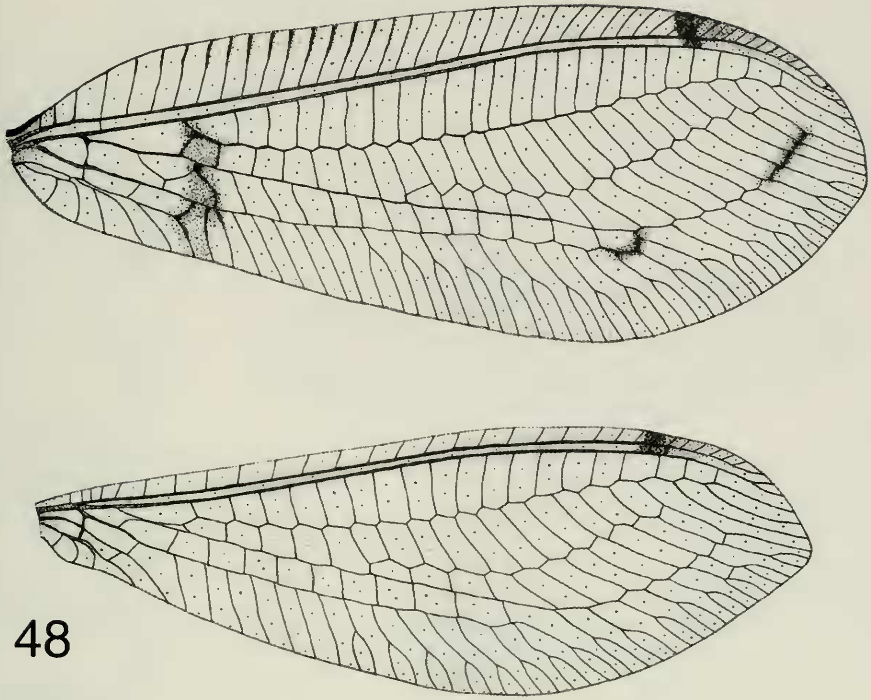
FIGURES 45–47. *Leucochrysa* (*Leucochrysa*) *adamsi* Penny. Fig. 45, right fore- and hind wings; Fig. 46, head in frontal view; Fig. 47, head and thorax in dorsal view. [Illustrations by Virginia Kirsch (45) and Norman Penny (46, 47)]



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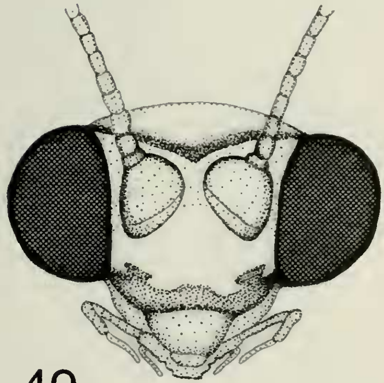

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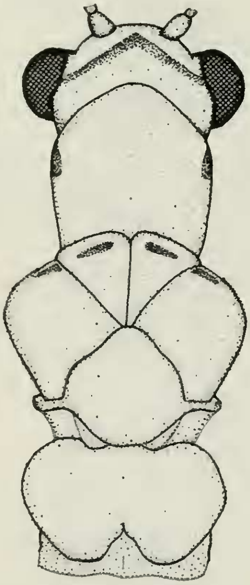

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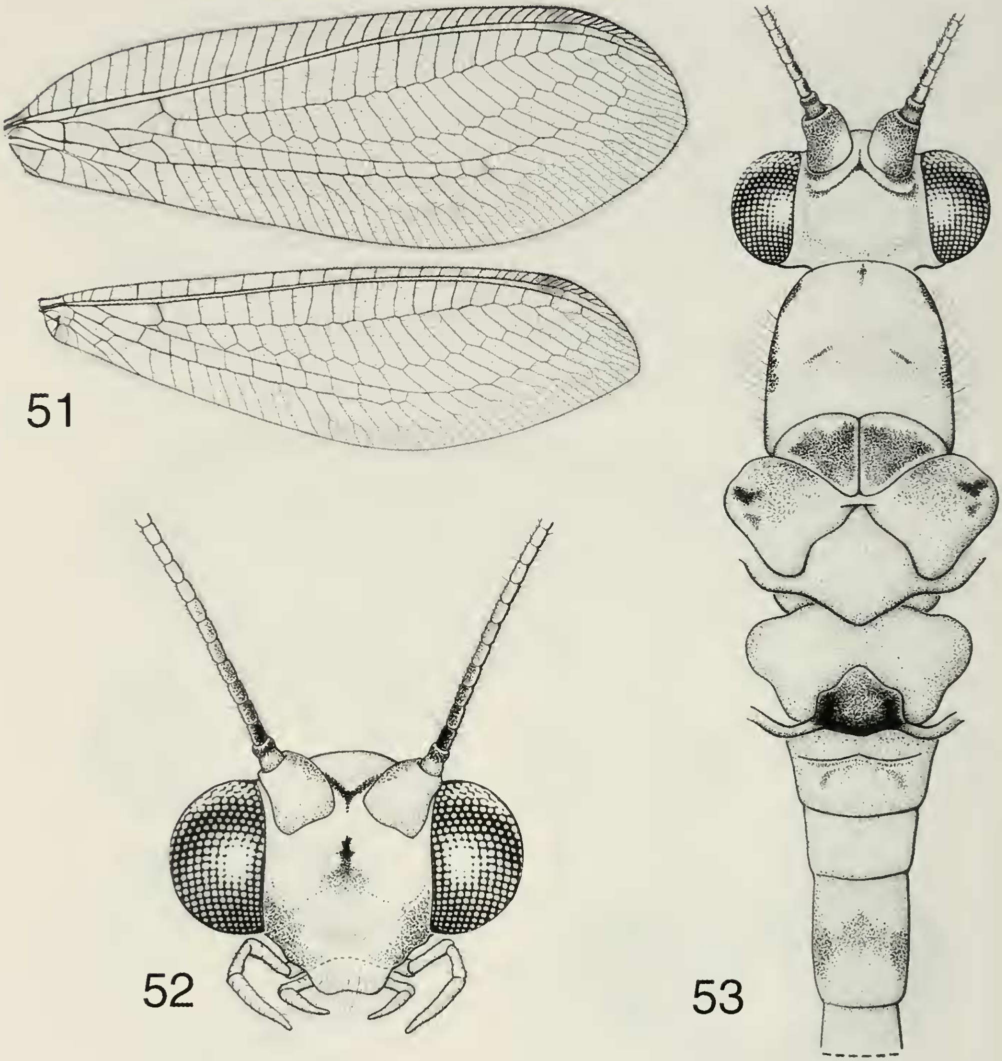
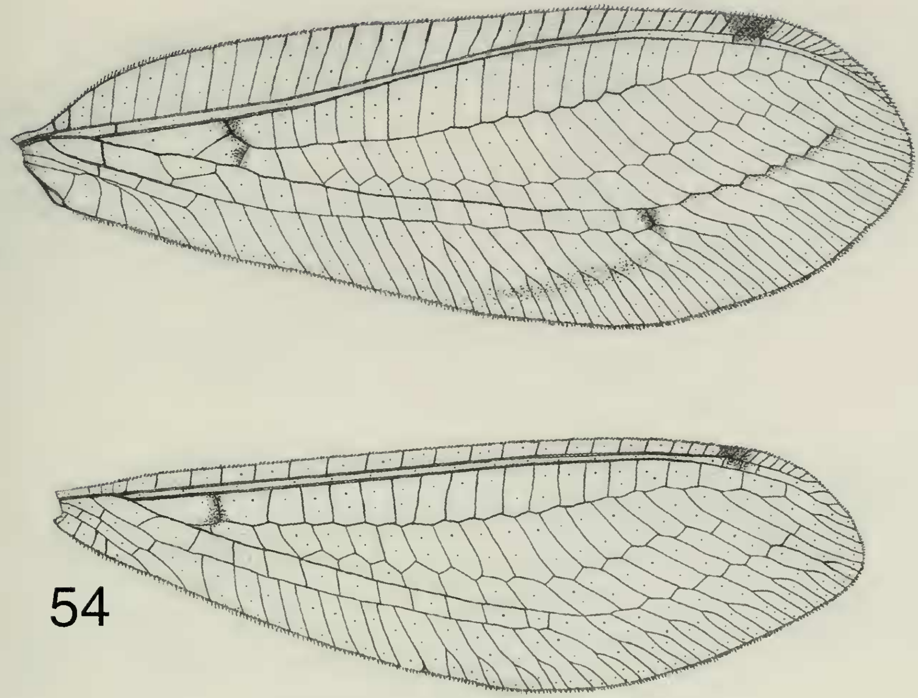
FIGURES 48–50. *Leucochrysa* (*Leucochrysa*) *clara* (McLachlan). Fig. 48, right fore- and hind wings; Fig. 49, head in frontal view; Fig. 50, head and thorax in dorsal view. (Illustrations by Fred Ehrman)



Figures 51–53. *Leucochrysa* (*Leucochrysa*) *colombia* (Banks). Fig. 51, right fore- and hind wings; Fig. 52, head in frontal view; Fig. 53, head and thorax in dorsal view. (Illustrations by Virginia Kirsch)



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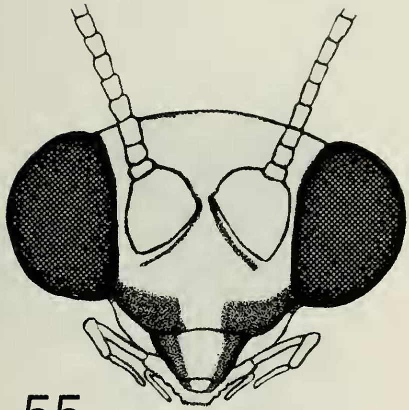

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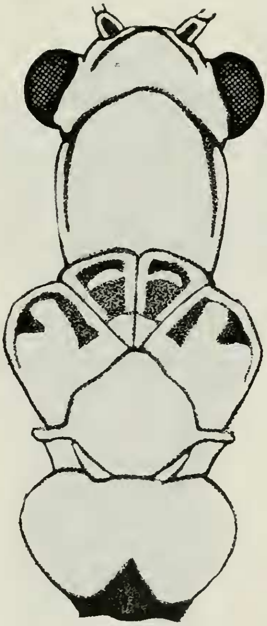

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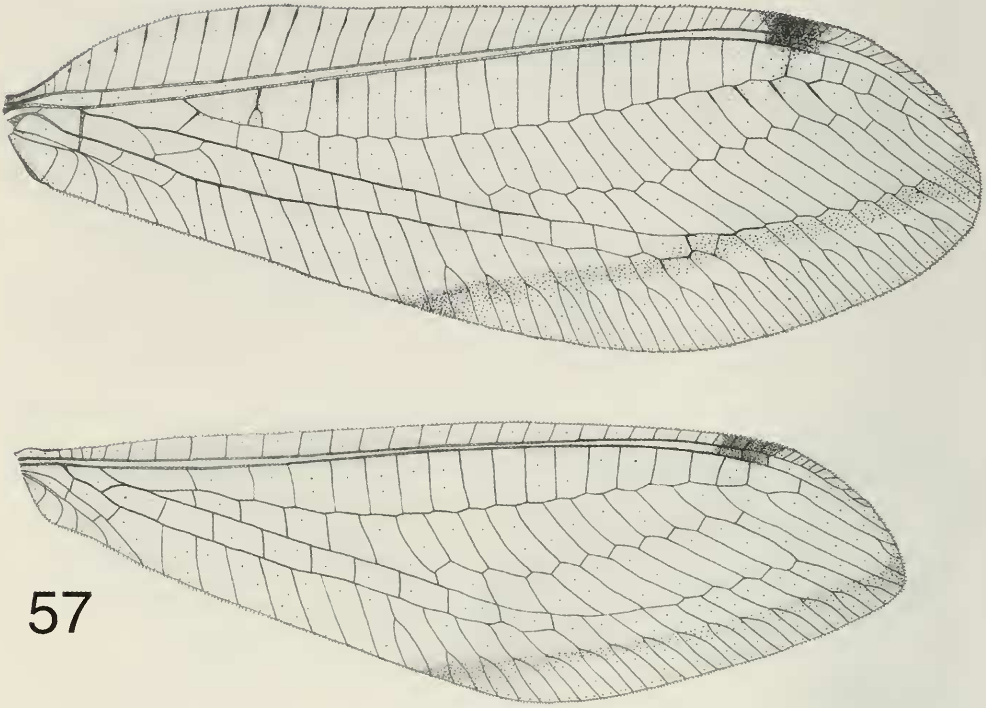
FIGURES 54–56. *Leucochrysa* (*Leucochrysa*) *lestagei* Navás. Fig. 54, right fore- and hind wings; Fig. 55, head in frontal view; Fig. 56, head and thorax in dorsal view. (Illustrations by Fred Ehrman).



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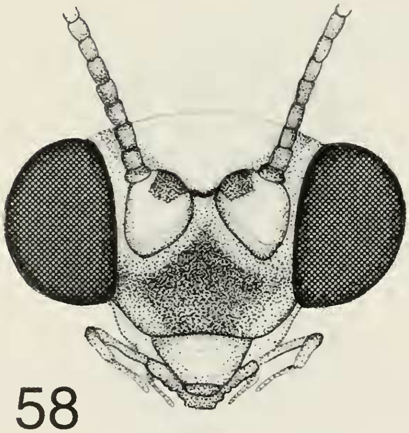

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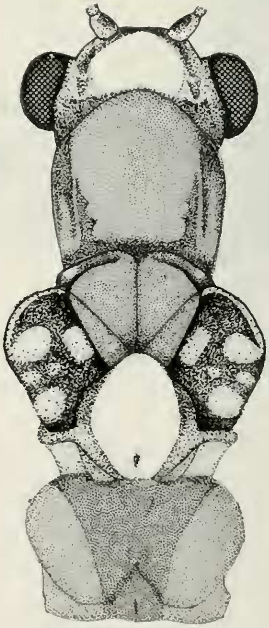

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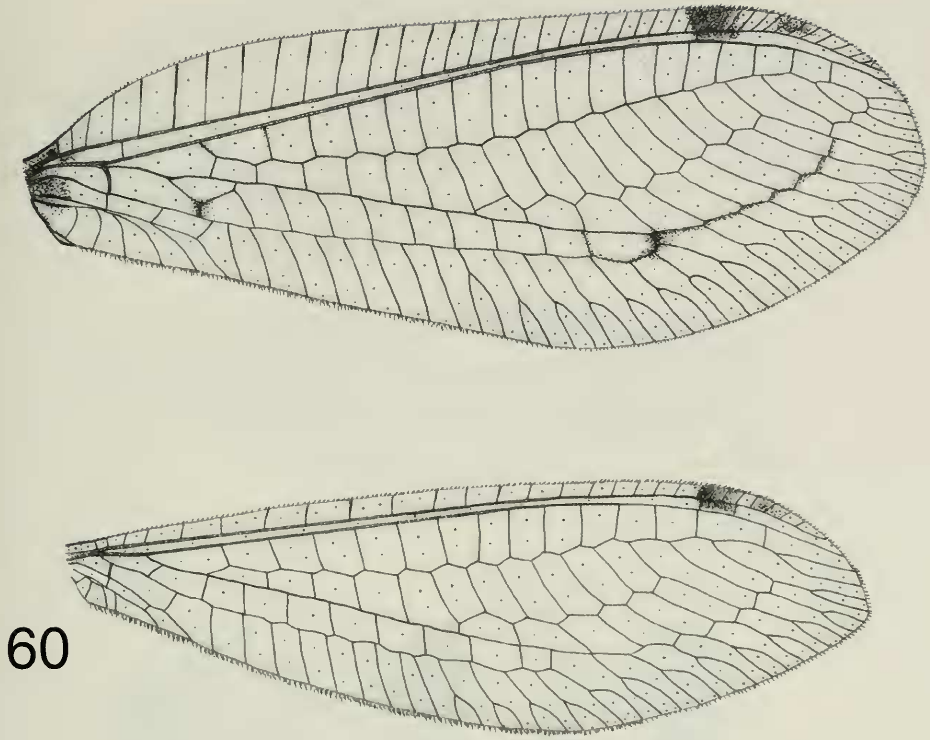
FIGURES 57–59. *Leucochrysa* (*Leucochrysa*) *magnifica* (Banks). Fig. 57, right fore- and hind wings; Fig. 58, head in frontal view; Fig. 59, head and thorax in dorsal view. (Illustrations by Fred Ehrman)



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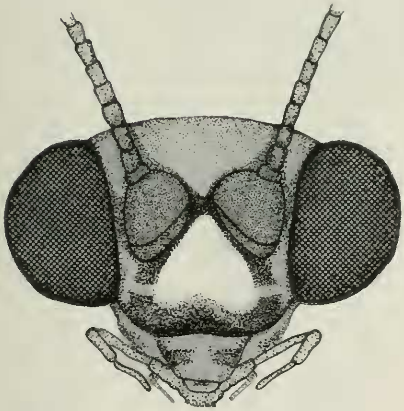

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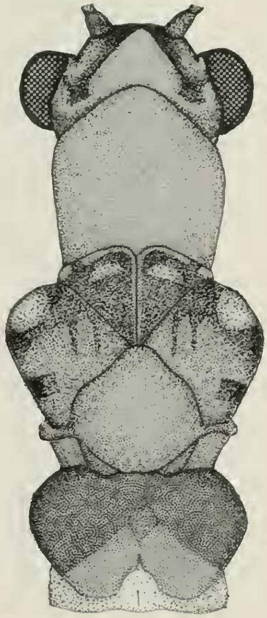
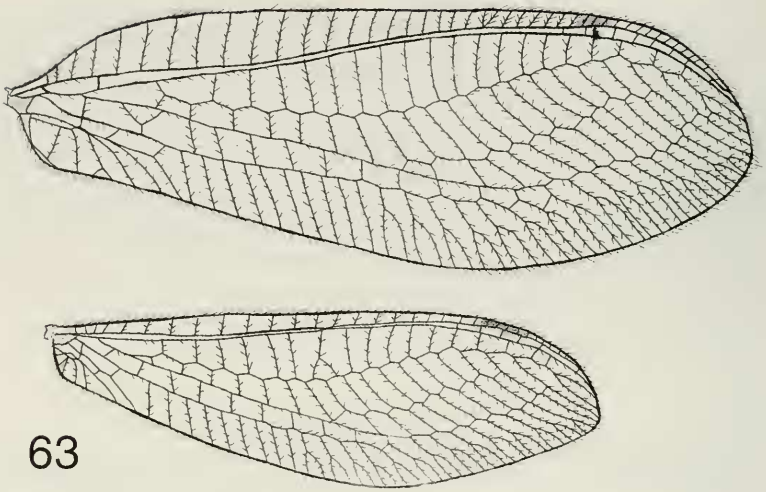


FIGURES 60–62. *Leucochrysa* (*Leucochrysa*) *pretiosa* (Banks). Fig. 60, right fore- and hind wings; Fig. 61, head in frontal view; Fig. 62, head and thorax in dorsal view. (Illustrations by Fred Ehrman)



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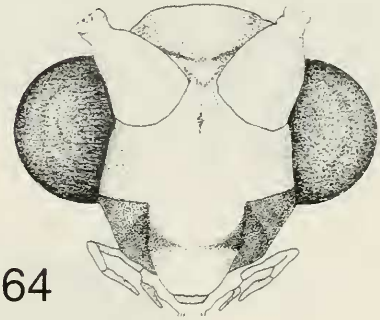

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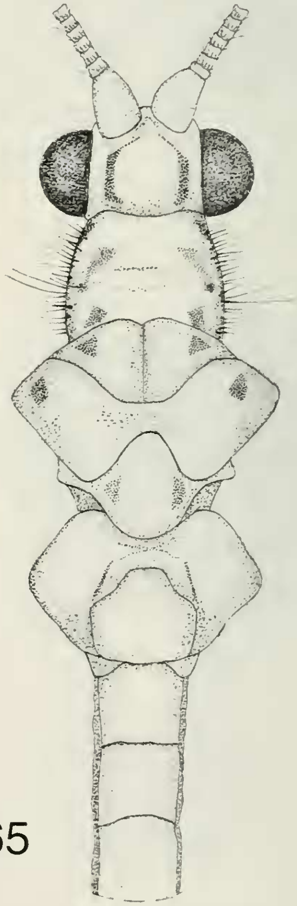

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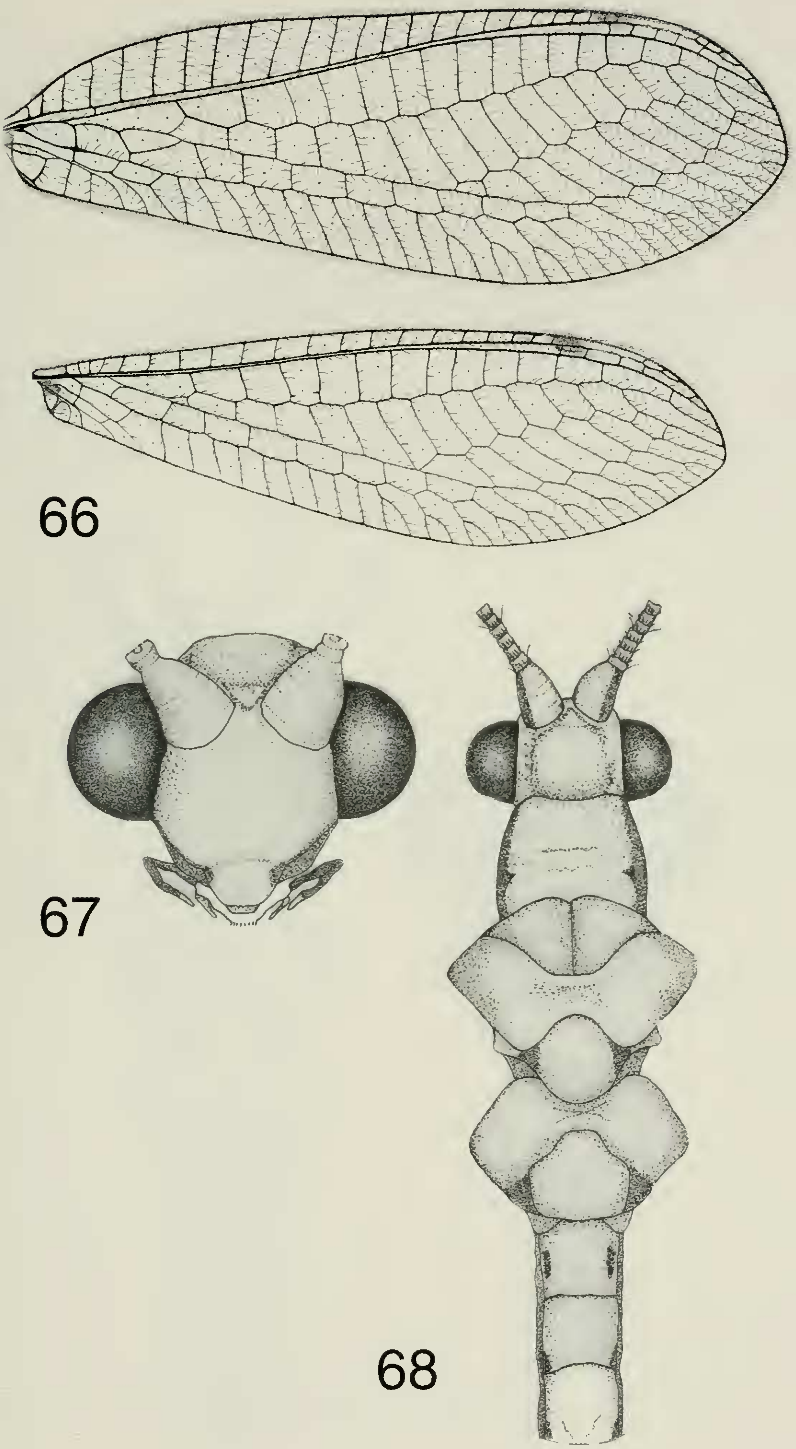
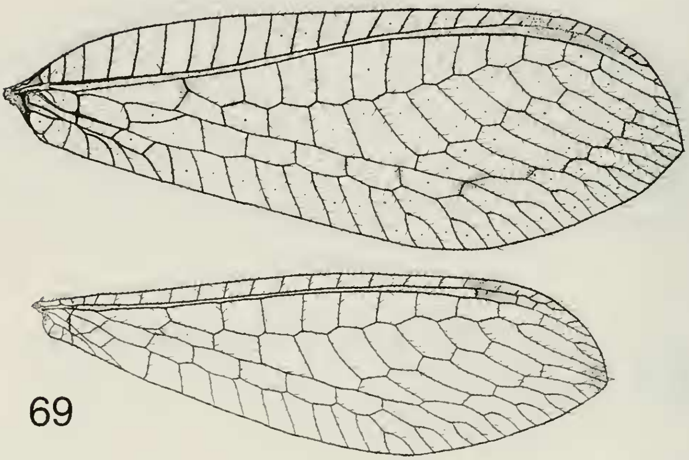
FIGURES 63–65. *Leucochrysa* (*Nodita*) *amazonica* Navás. Fig. 63, right fore- and hind wings; Fig. 64, head in frontal view; Fig. 65, head and thorax in dorsal view. [Illustrations by Diane T. Sands (63) and Zena Deretsky (64, 65)]



FIGURES 66–68. *Leucochrysa* (*Nodita*) *amistadensis* Penny. Fig. 66, right fore- and hind wings; Fig. 67, head in frontal view; Fig. 68, head and thorax in dorsal view. [Reprinted from Penny (2001)]



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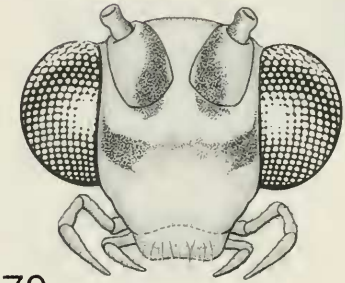

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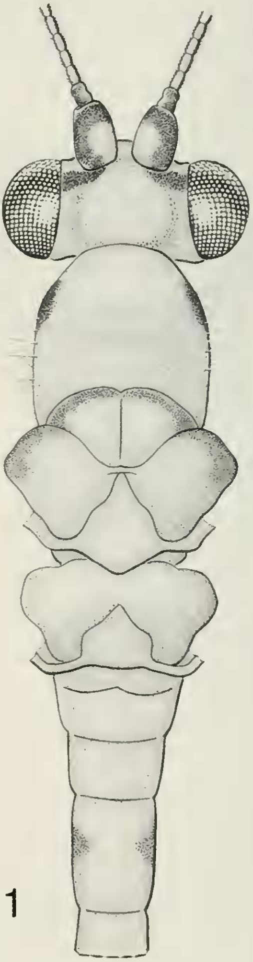

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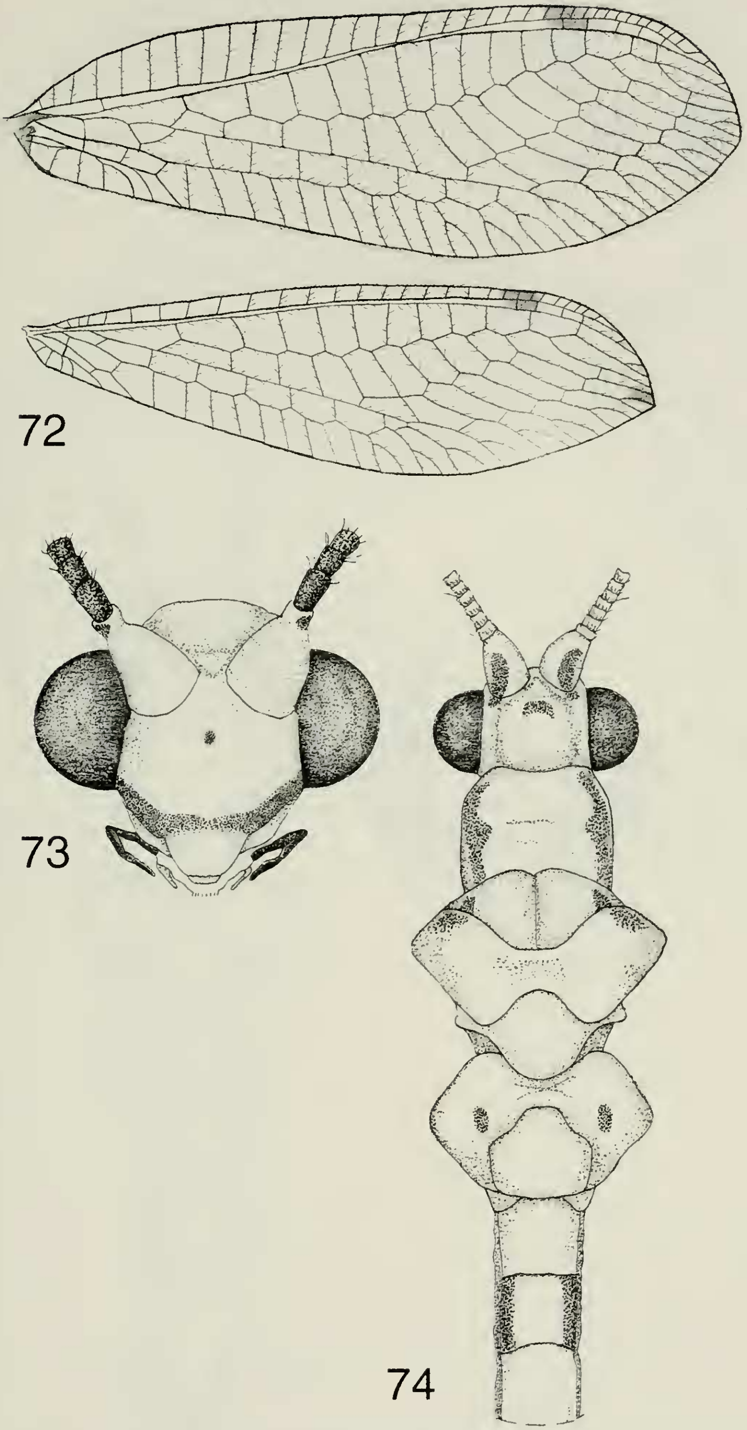
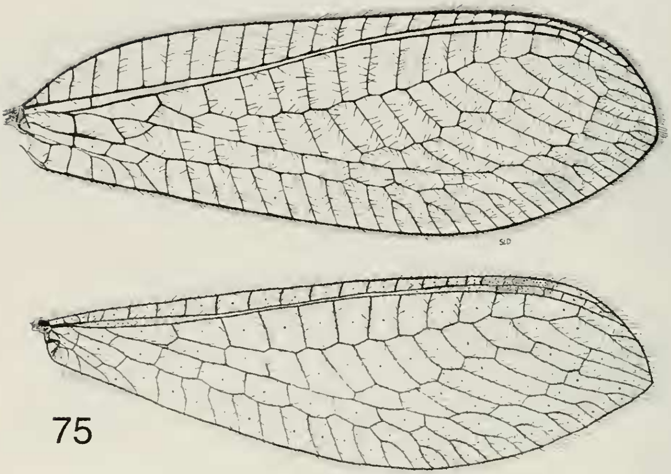
FIGURES 69–71. *Leucochrysa* (*Nodita*) *antica* Navás. Fig. 69, right fore- and hind wings; Fig. 70, head in frontal view; Fig. 71, head and thorax in dorsal view. [Illustrations by Renata Zakhvatkina (69) and Virginia Kirsch (70, 71)]



FIGURES 72–74. *Leucochrysa* (*Nodita*) *askanes* (Banks). Fig. 72, right fore- and hind wings; Fig. 73, head in frontal view; Fig. 74, head and thorax in dorsal view. [Illustrations by Diane T. Sands (72) and Victoria Saxe (73, 74)]



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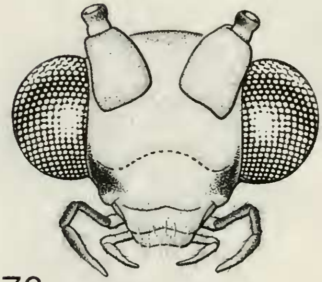

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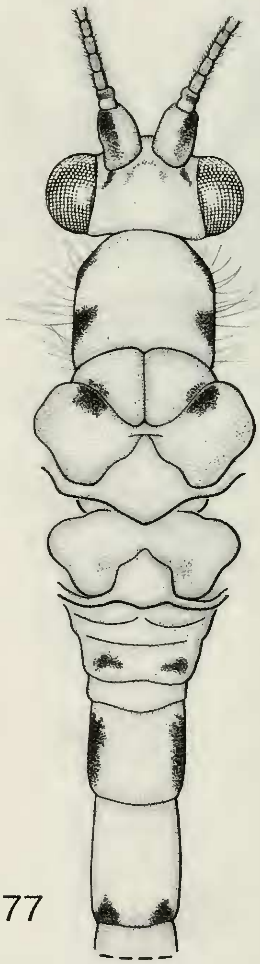

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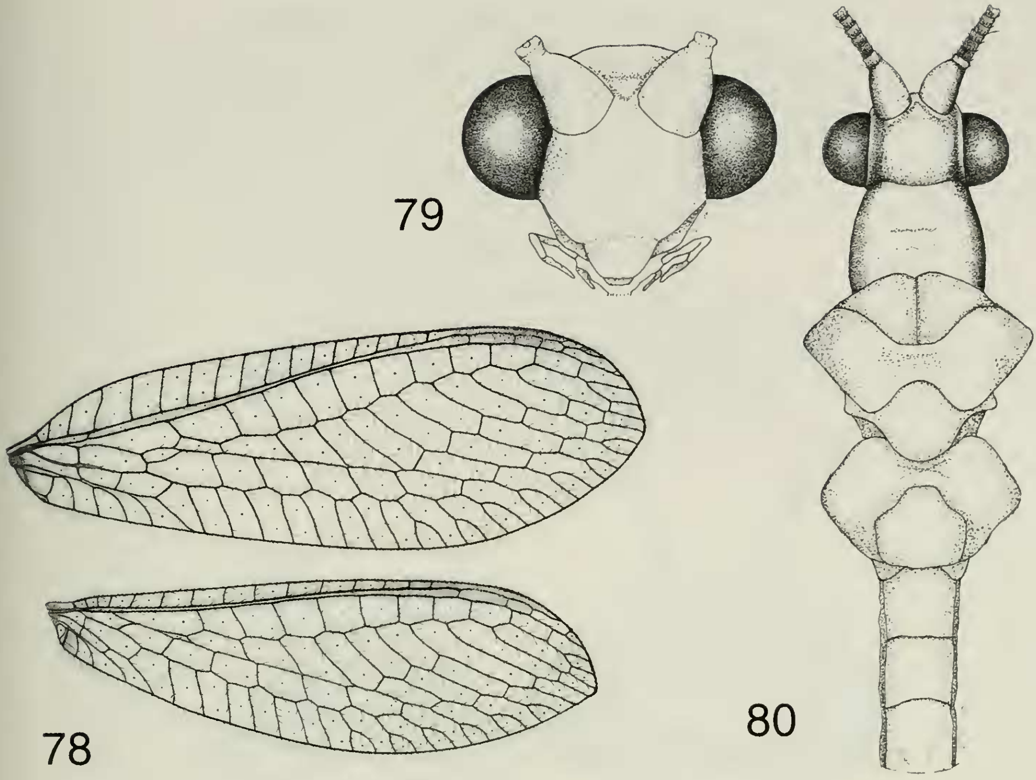
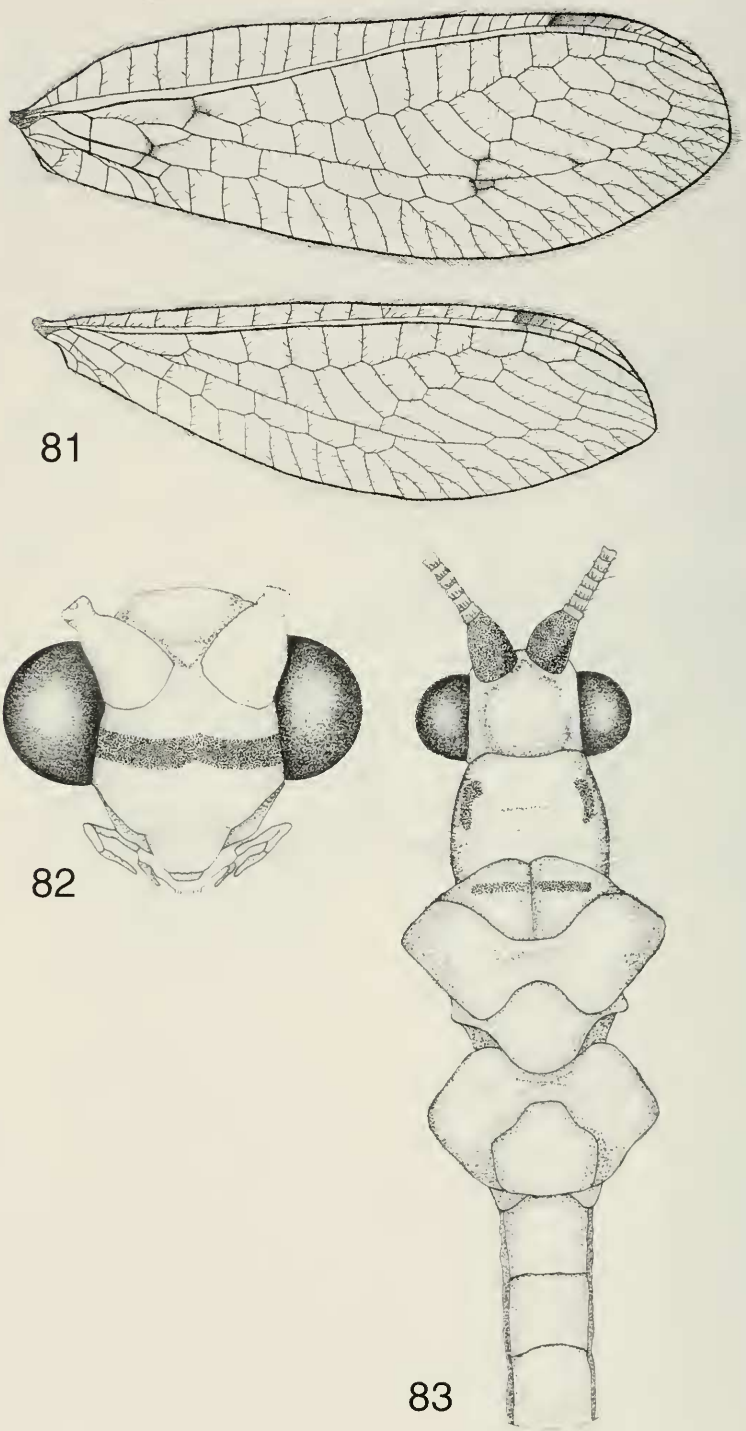
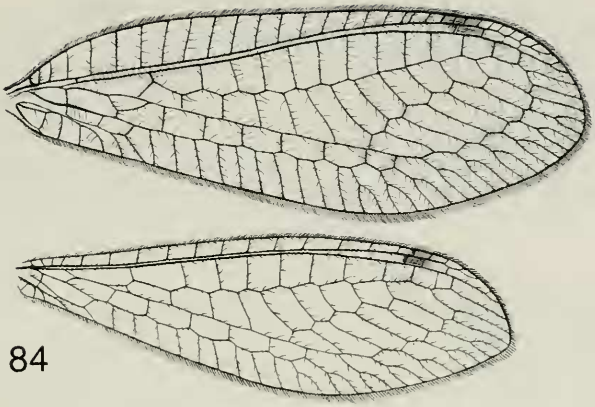
FIGURES 75–77. *Leucochrysa* (*Nodita*) *caucella* Banks. Fig. 75, right fore- and hind wings; Fig. 76, head in frontal view; Fig. 77, head and thorax in dorsal view. [Illustrations by Sarah Donelson (75, forewing), Renata Zakhvatkina (75, hind wing), and Virginia Kirsch (76, 77)]



FIGURES 78–80. *Leucochrysa* (*Nodita*) *compar* (Navás). Fig. 78, right fore- and hind wings; Fig. 79, head in frontal view; Fig. 80, head and thorax in dorsal view. [Illustrations by Virginia Kirsch (78) and Victoria Saxe (79, 80)]



Figures 81–83. *Leucochrysa* (*Nodita*) *cornesta* (Banks). Fig. 81, right fore- and hind wings; Fig. 82, head in frontal view; Fig. 83, head and thorax in dorsal view. [Illustrations by Diane T. Sands (81) and Zena Deretsky (82, 83)]



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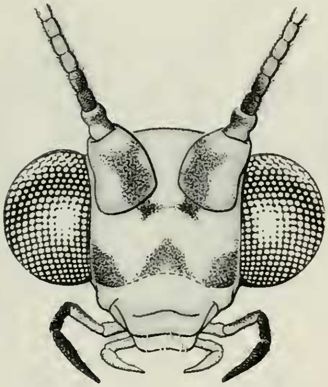

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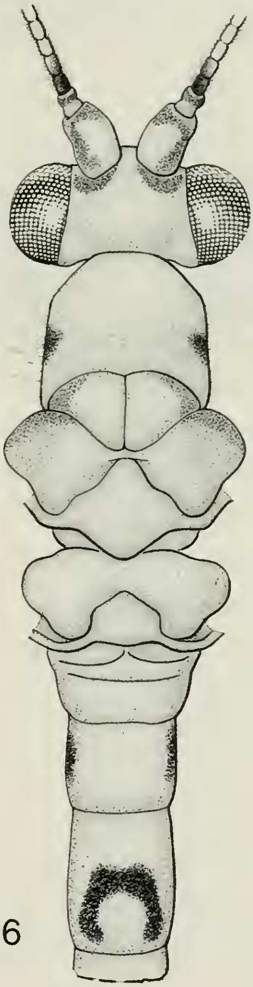

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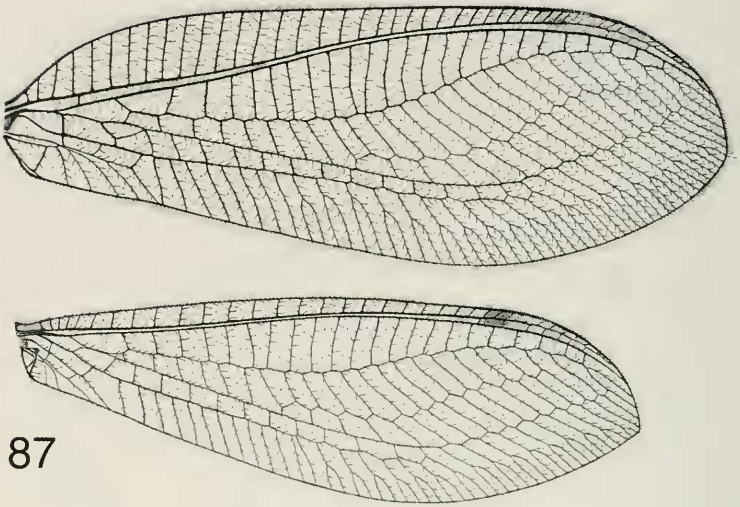
FIGURES 84–86. *Leucochrysa* (*Nodita*) *duarte* Banks. Fig. 84, right fore- and hind wings; Fig. 85, head in frontal view; Fig. 86, head and thorax in dorsal view. [Illustrations by Michelle Schwengel (84) and Virginia Kirsch (85, 86)]



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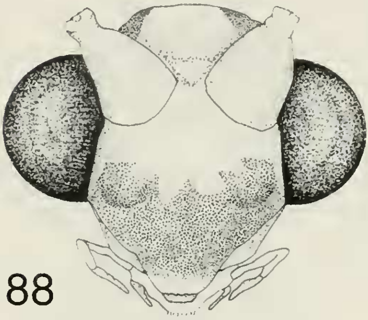

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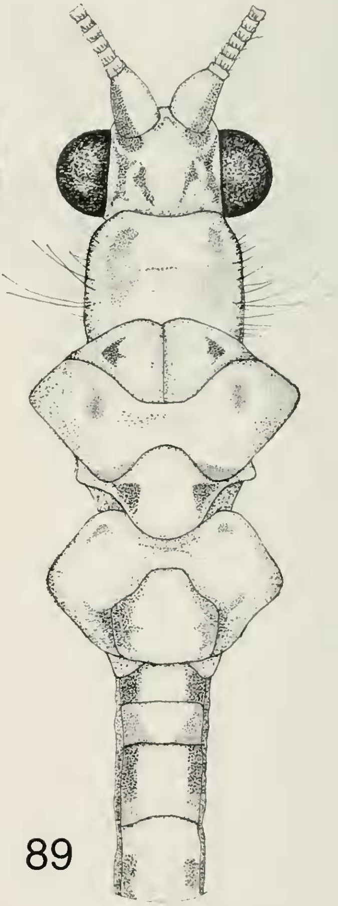

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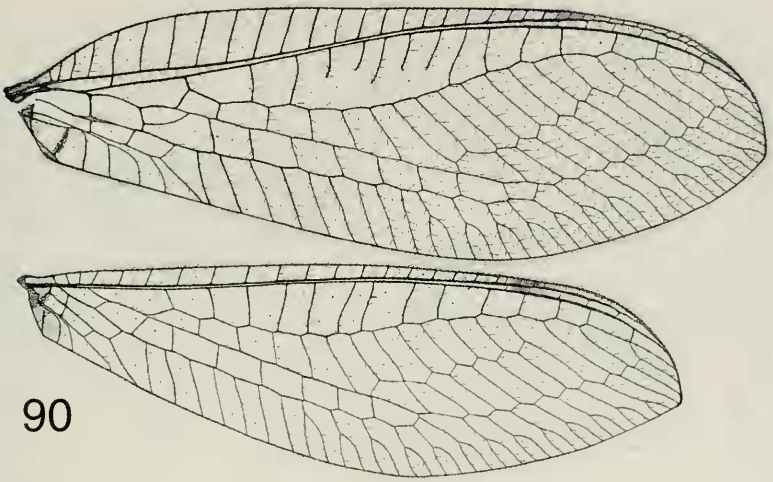
FIGURES 87–89. *Leucochrysa* (*Nodita*) *egregia* Navás. Fig. 87, right fore- and hind wings; Fig. 88, head in frontal view; Fig. 89, head and thorax in dorsal view. [Illustrations by Virginia Kirsch (87) and Zena Deretsky (88, 89)]



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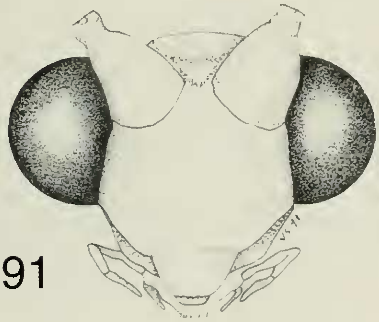

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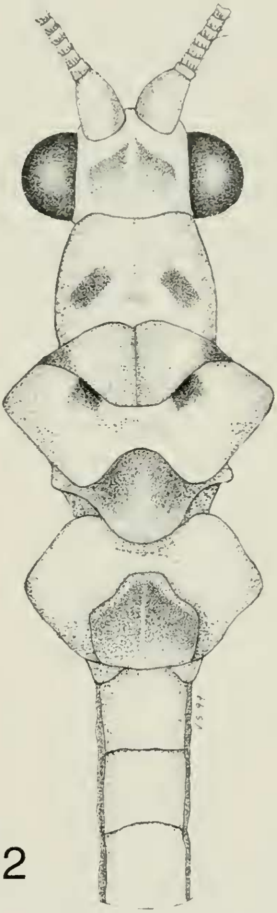

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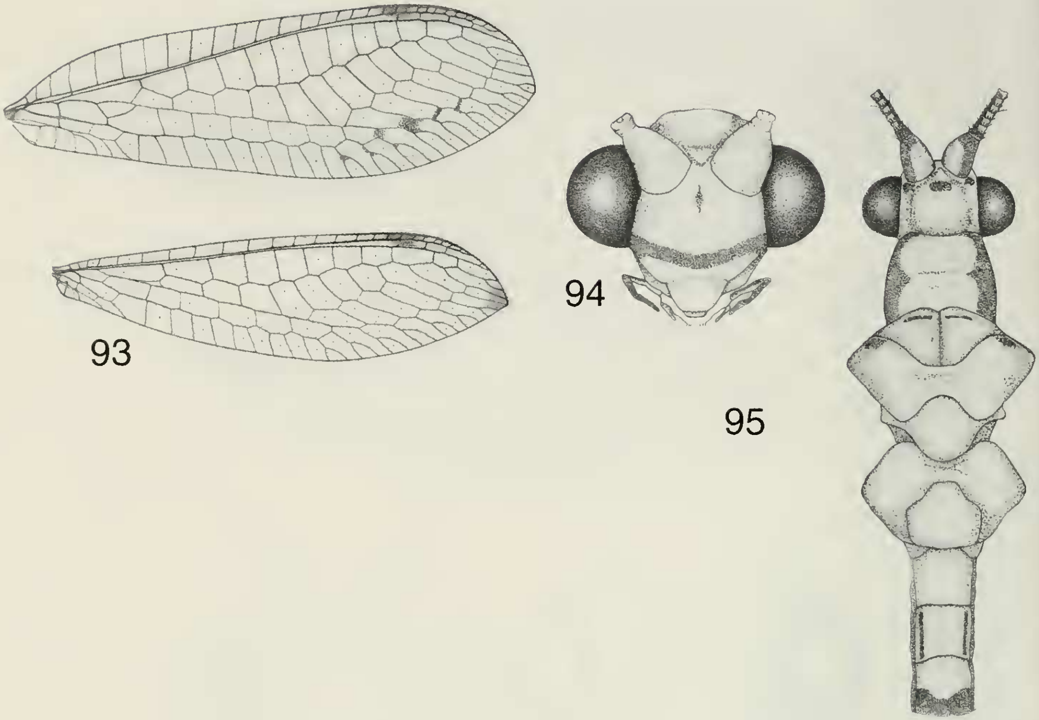
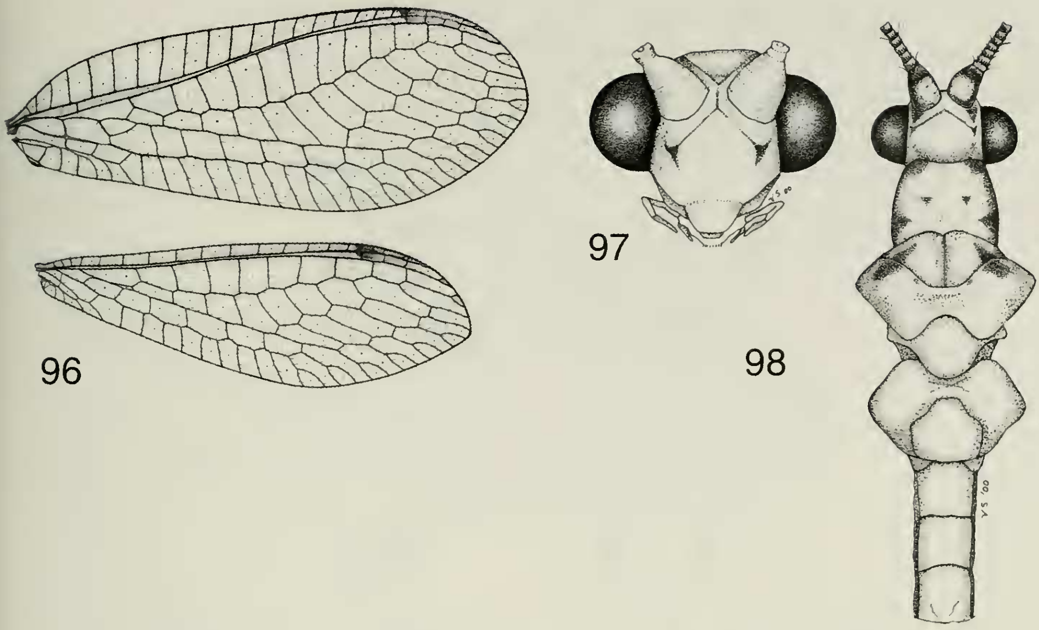
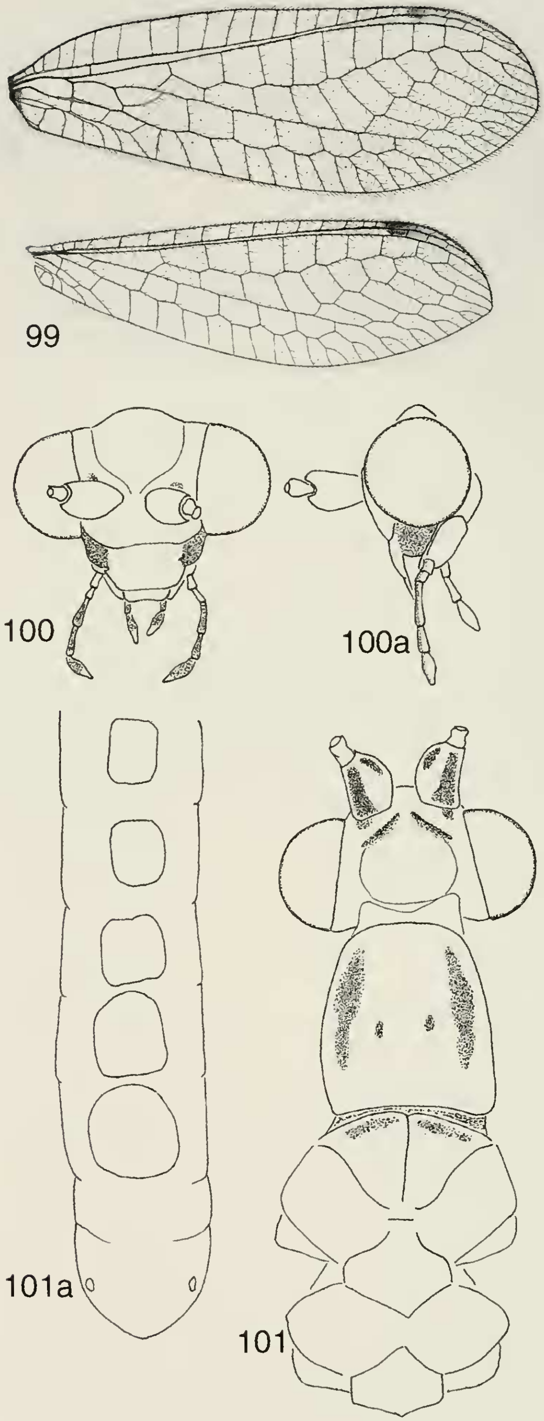
FIGURES 90–92. *Leucochrysa* (*Nodita*) *forcipata* Penny. Fig. 90, right fore- and hind wings; Fig. 91, head in frontal view; Fig. 92, head and thorax in dorsal view. [Illustrations by Virginia Kirsch (90) and Victoria Saxe (91, 92)].



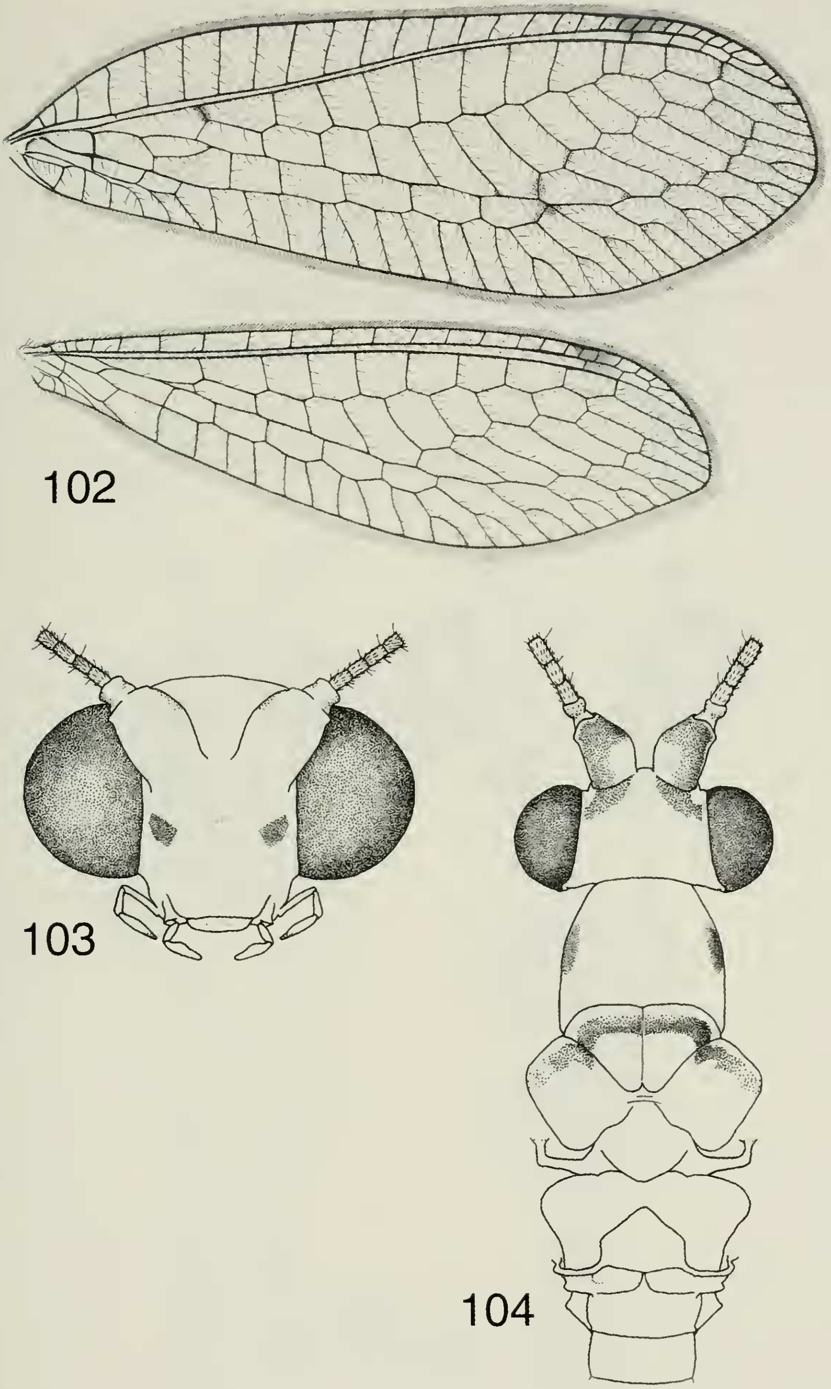
FIGURES 93–95. *Leucochrysa* (*Nodita*) *indiga* Navás. Fig. 93, right fore- and hind wings; Fig. 94, head in frontal view; Fig. 95, head and thorax in dorsal view. [Reprinted from Penny (2001)]



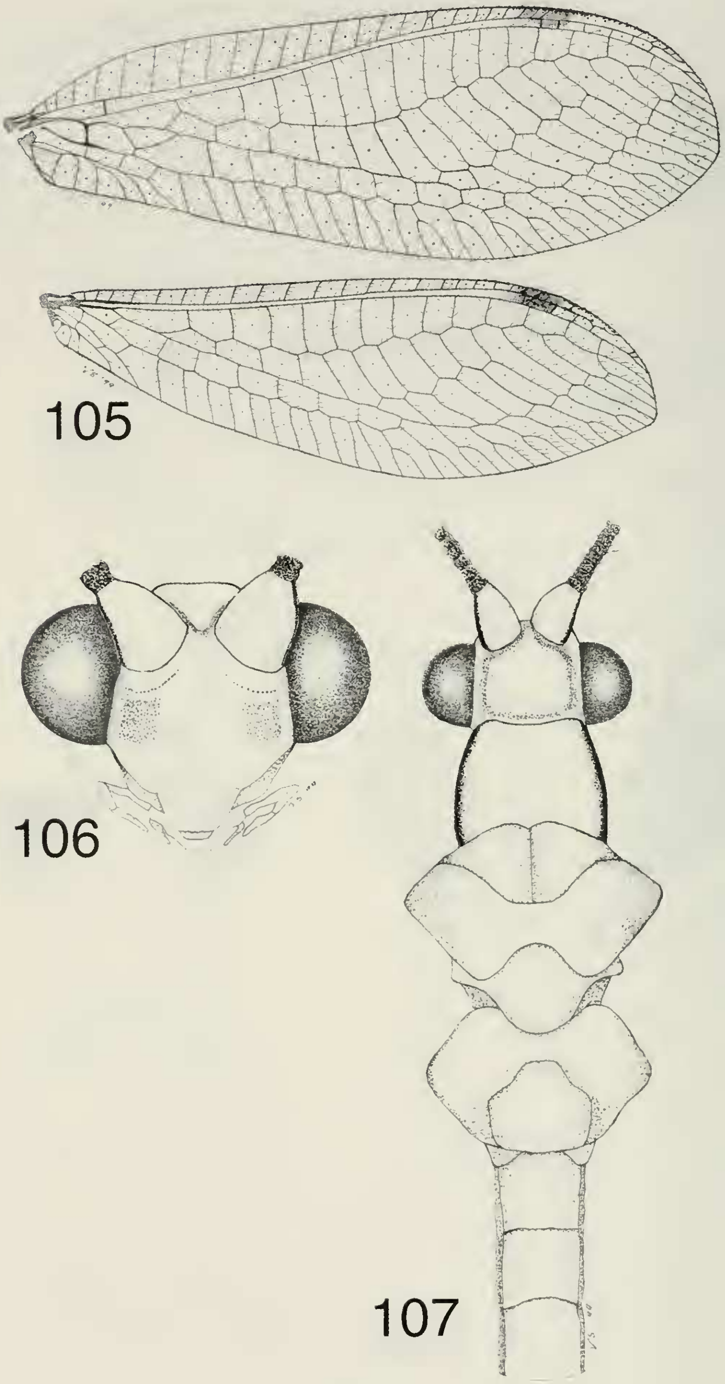
FIGURES 96–98. *Leucochrysa* (*Nodita*) *laertes* (Banks). Fig. 96, right fore- and hind wings; Fig. 97, head in frontal view; Fig. 98, head and thorax in dorsal view. [Illustrations by Virginia Kirsch (96) and Victoria Saxe (97, 98)]



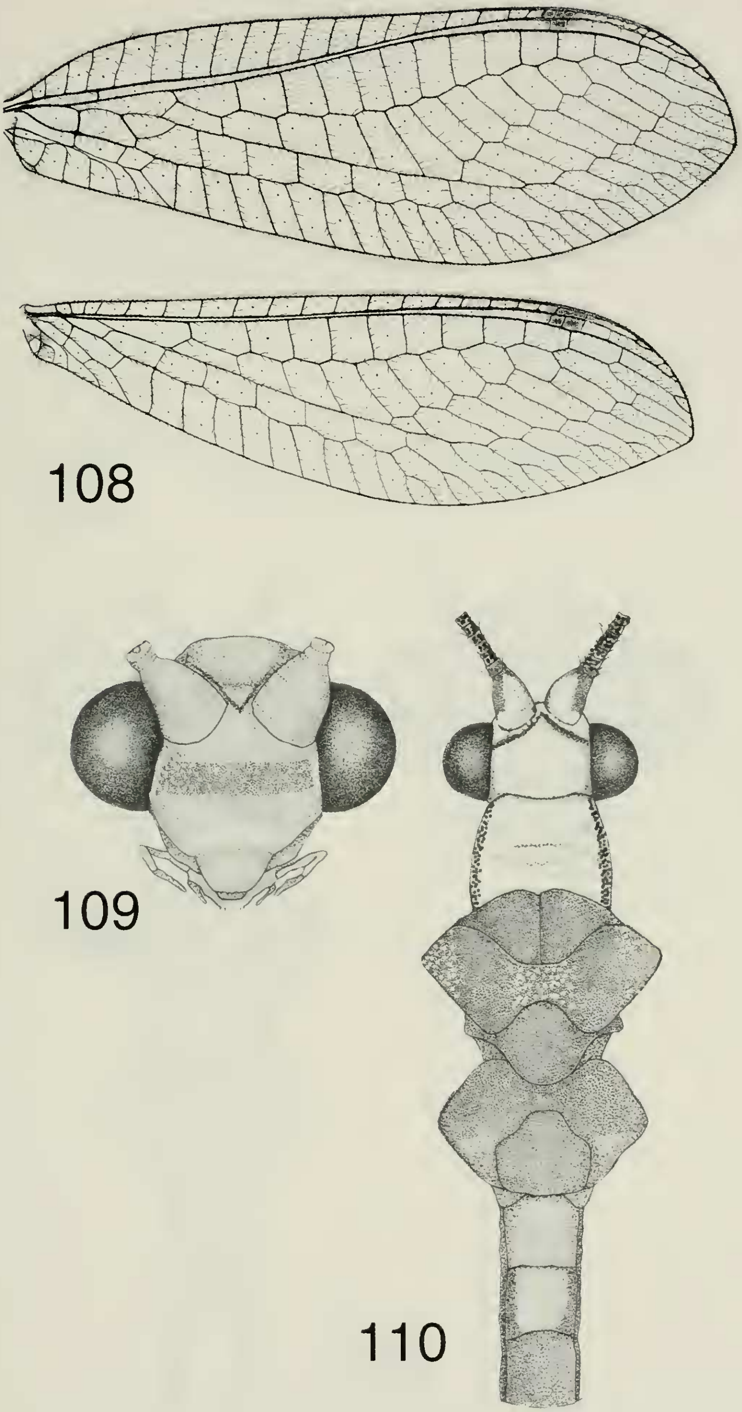
FIGURES 99–101. *Leucochrysa* (*Nodita*) *lancala* (Banks). Fig. 99, right fore- and hind wings; Fig. 100, head in frontal view; Fig. 100a, head in lateral view; Fig. 101, head and thorax in dorsal view; Fig. 101a, abdomen in dorsal view. [Illustrations by Virginia Kirsch (99) and Sergio da Freitas (100, 100a, 101, 101a)]



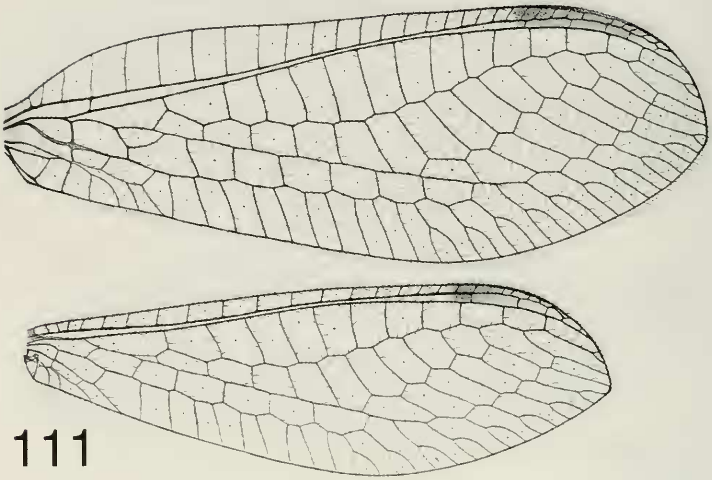
FIGURES 102–104. *Leucochrysa* (*Nodita*) *lenora* (Banks). Fig. 102, right fore- and hind wings; Fig. 103, head in frontal view; Fig. 104, head and thorax in dorsal view. [Illustrations by Virginia Kirsch (102) and Michelle Schwengel (103, 104)]



Figures 105–107. *Leucochrysa* (*Nodita*) *navasi* Kimmins. Fig. 105, right fore- and hind wings; Fig. 106, head in frontal view; Fig. 107, head and thorax in dorsal view. [Illustrations by Victoria Saxe (105, forewing; 106, 107) and Virginia Kirsch (105, hind wing)]



FIGURES 108–110. *Leucochrysa* (*Nodita*) *nigrovaria* (Walker). Fig. 108, right fore- and hind wings; Fig. 109, head in frontal view; Fig. 110, head and thorax in dorsal view. [Modified from Penny (2001)]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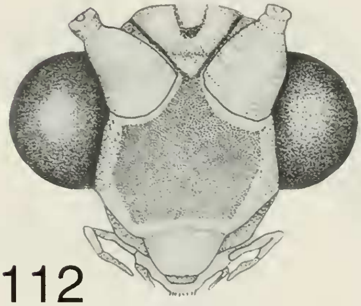
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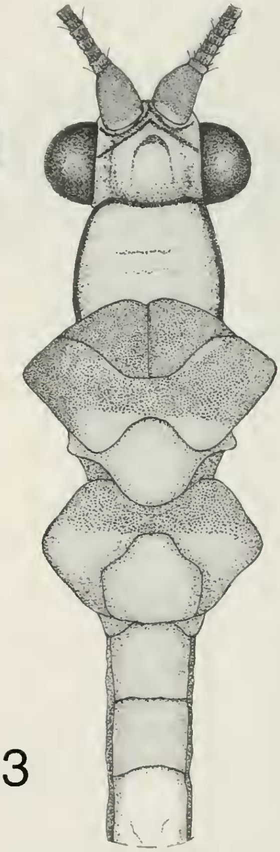
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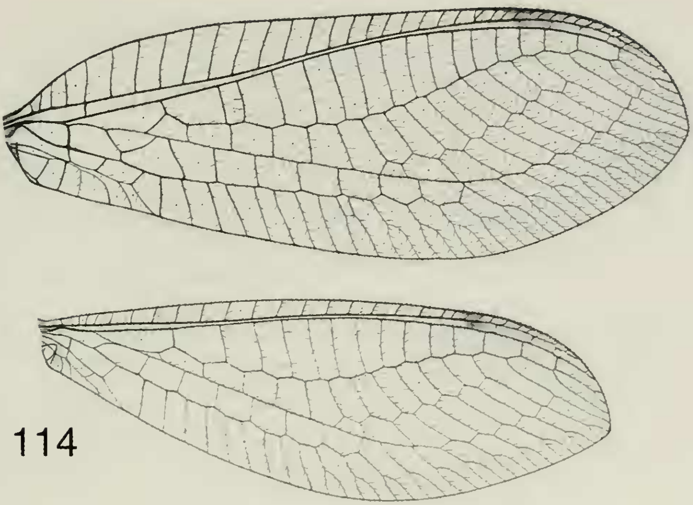
FIGURES 111–113. *Leucochrysa* (*Nodita*) *oenops* Adams. Fig. 111, right fore- and hind wings; Fig. 112, head in frontal view; Fig. 113, head and thorax in dorsal view. [Illustrations by Virginia Kirsch (111) and Norman Penny (112, 113)]



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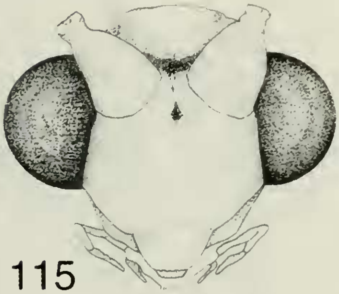

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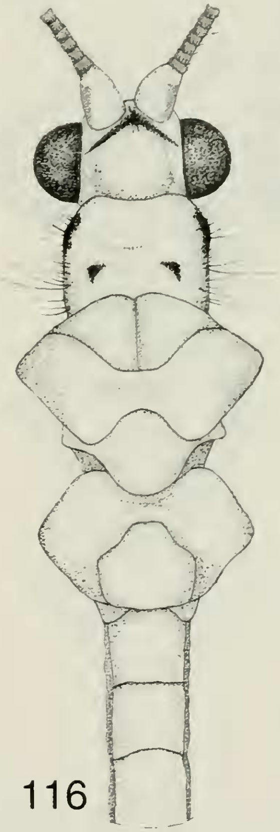

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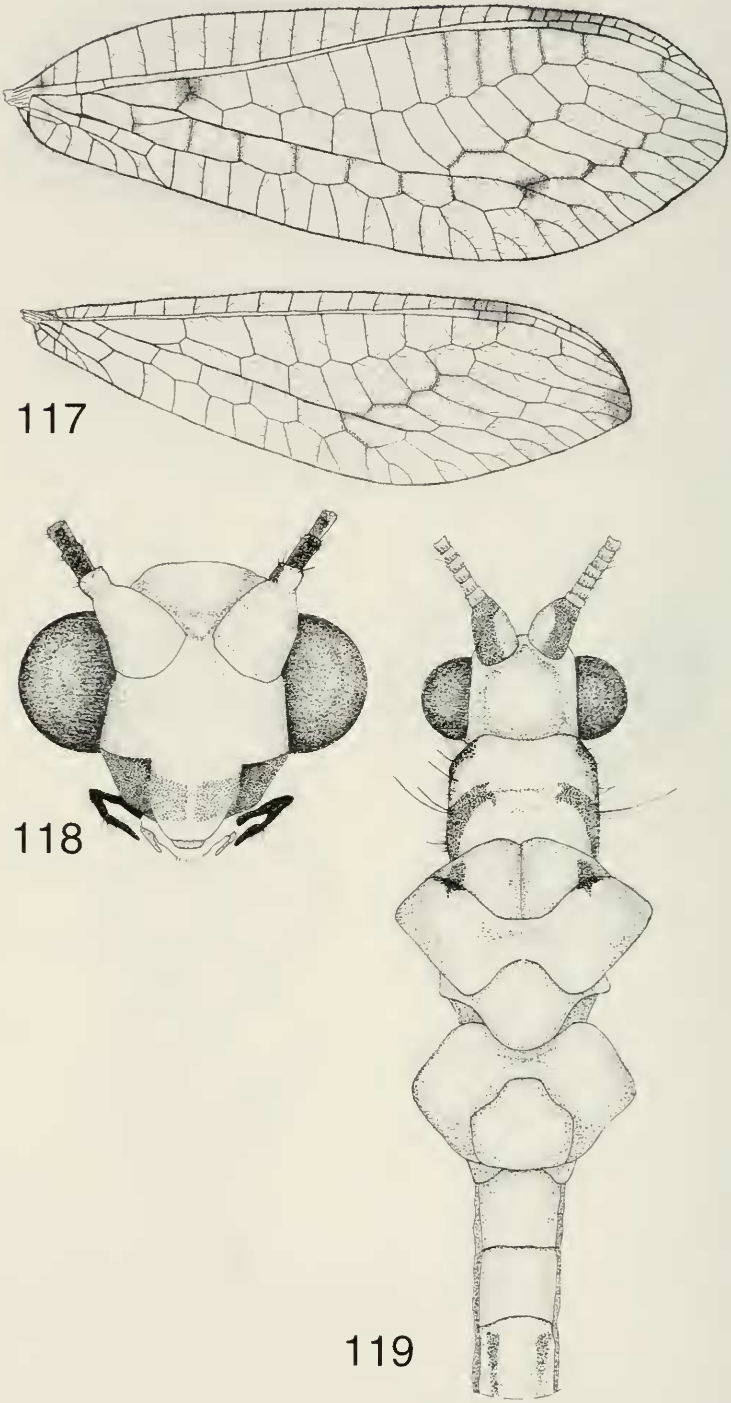
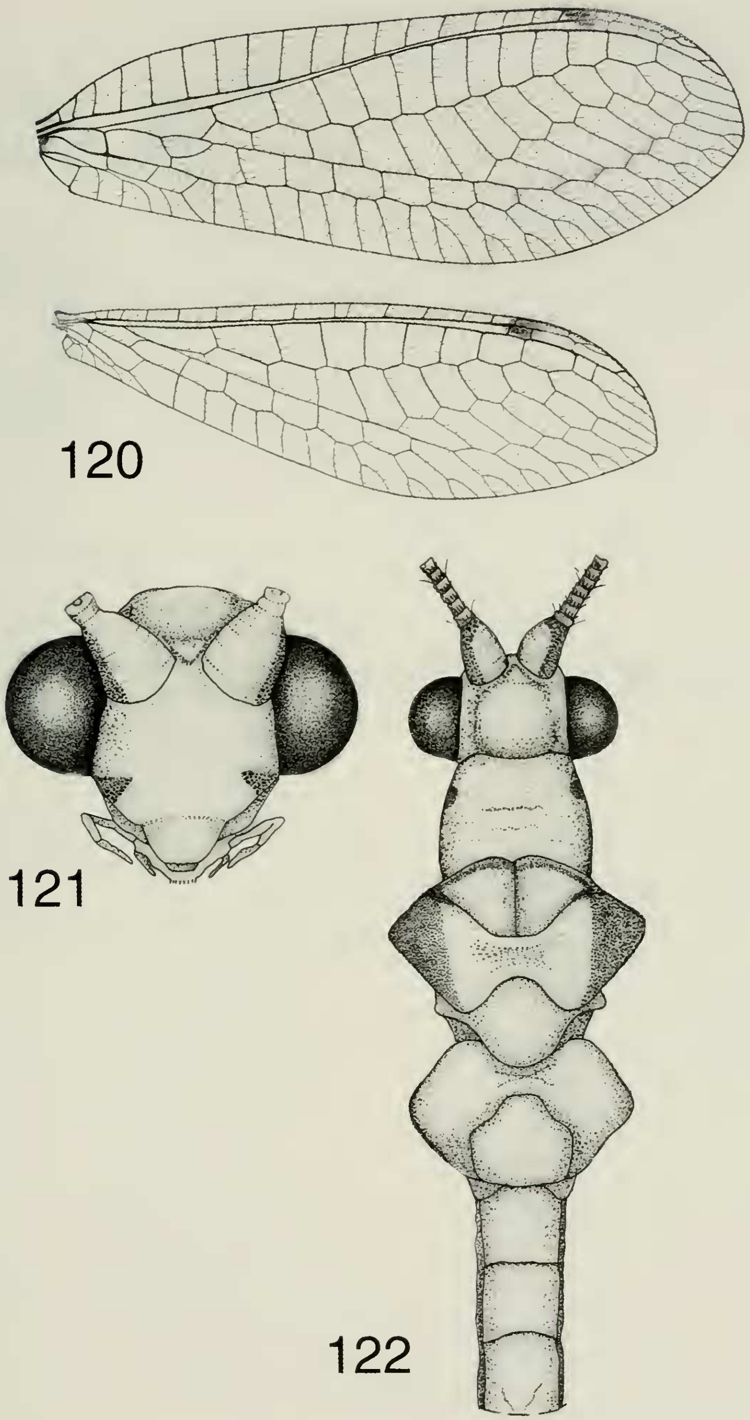
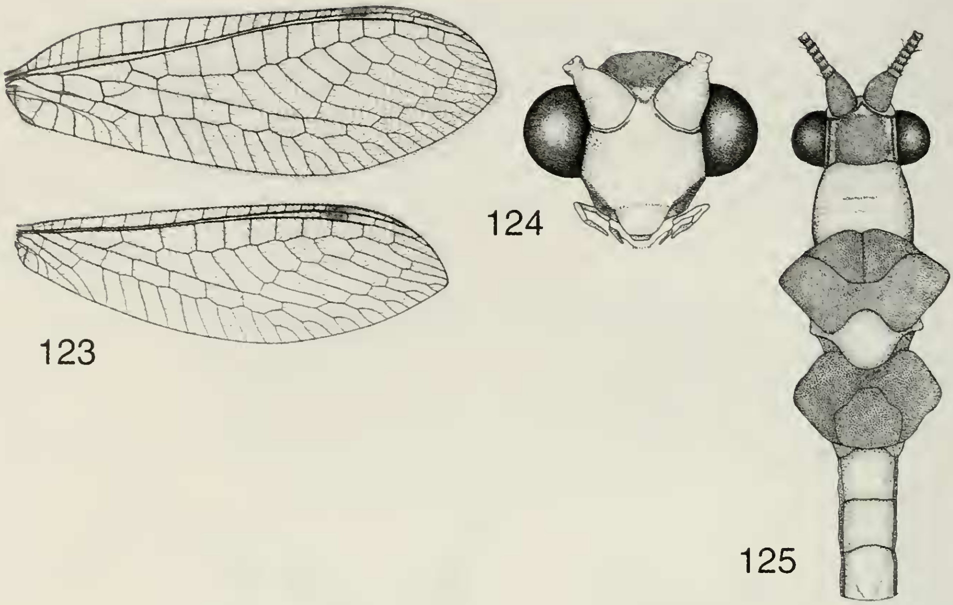
FIGURES 114–116. *Leucochrysa* (*Nodita*) *pallescens* (Banks). Fig. 114, right fore- and hind wings; Fig. 115, head in frontal view; Fig. 116, head and thorax in dorsal view. [Illustrations by Virginia Kirsch (114) and Zena Deretsky (115, 116)]



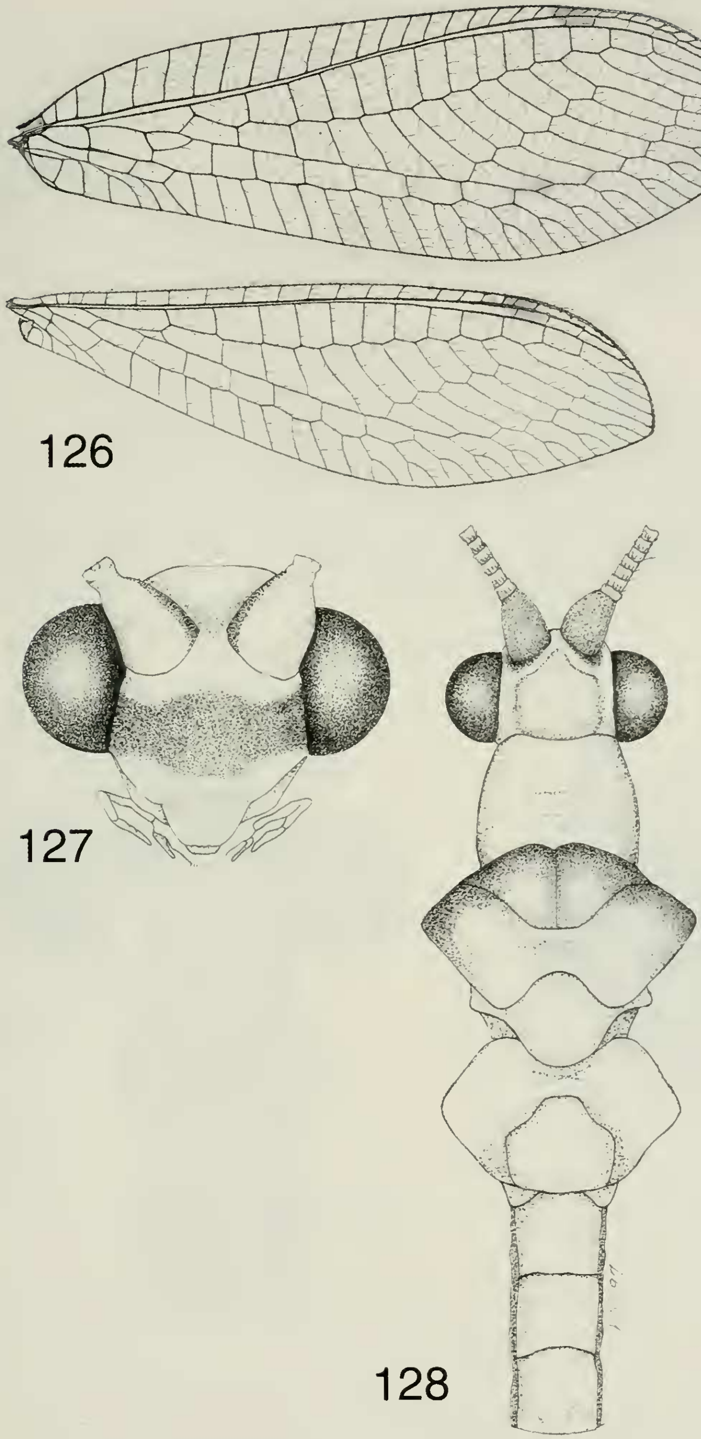
FIGURES 117–119. *Leucochrysa* (*Nodita*) *postica* Navás. Fig. 117, right fore- and hind wings; Fig. 118, head in frontal view; Fig. 119, head and thorax in dorsal view. [Illustrations by Diane T. Sands (117) and Victoria Saxe (118, 119)]



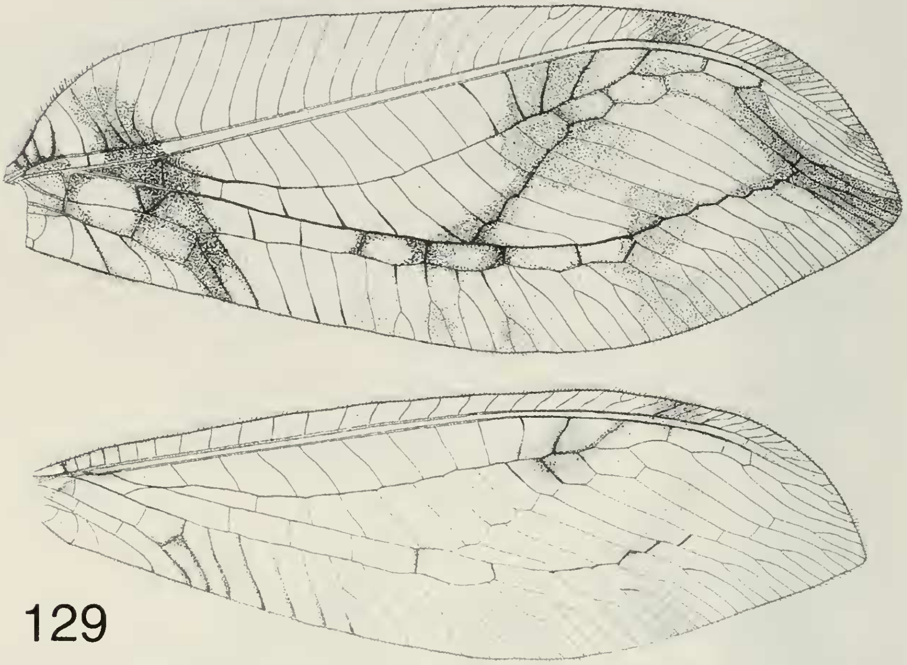
FIGURES 120–122. *Leucochrysa* (*Nodita*) *ratcliffei* Penny. Fig. 120, right fore- and hind wings; Fig. 121, head in frontal view; Fig. 122, head and thorax in dorsal view. [Reprinted from Penny (2001)]



FIGURES 123–125. *Leucochrysa* (*Nodita*) *serrei* (Navás) (sp. E). Fig. 123, right fore- and hind wings; Fig. 124, head in frontal view; Fig. 125, head and thorax in dorsal view. [Illustrations by Virginia Kirsch (123) and Norman Penny (124, 125)]



FIGURES 126–128. *Leucochrysa* (*Nodita*) *virginiae* Penny. Fig. 126, right fore- and hind wings; Fig. 127, head in frontal view; Fig. 128, head and thorax in dorsal view. [Reprinted from Penny (1998)]



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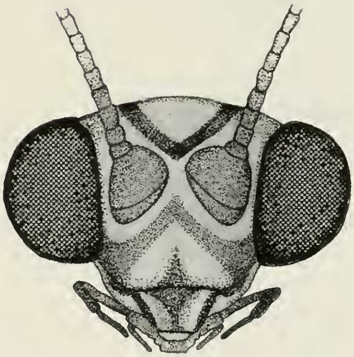

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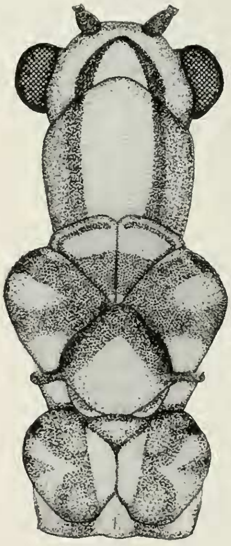

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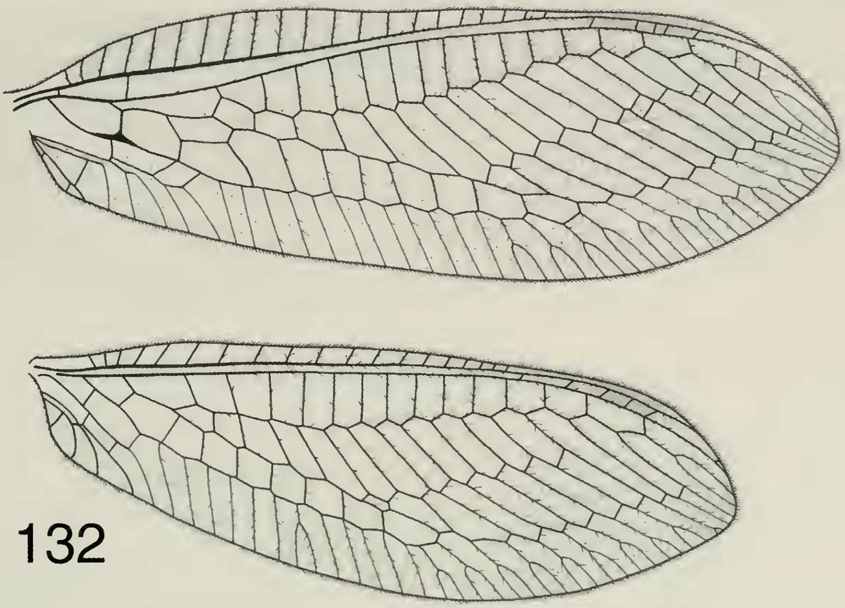
Figures 129–131. *Vieira leschnaulti* (Navás). Fig. 129, right fore- and hind wings; Fig. 130, head in frontal view; Fig. 131, head and thorax in dorsal view. (Illustrations by Fred Ehrman)



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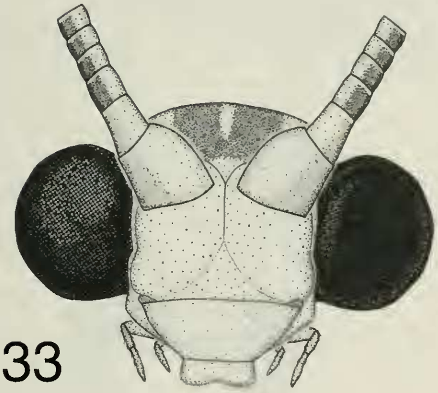

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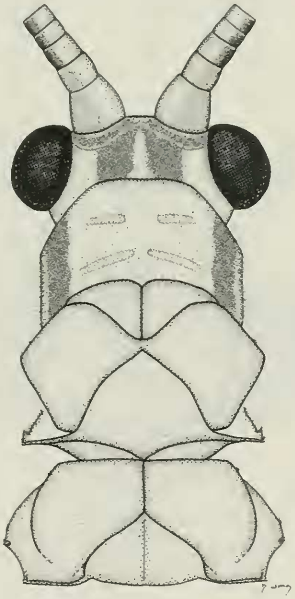

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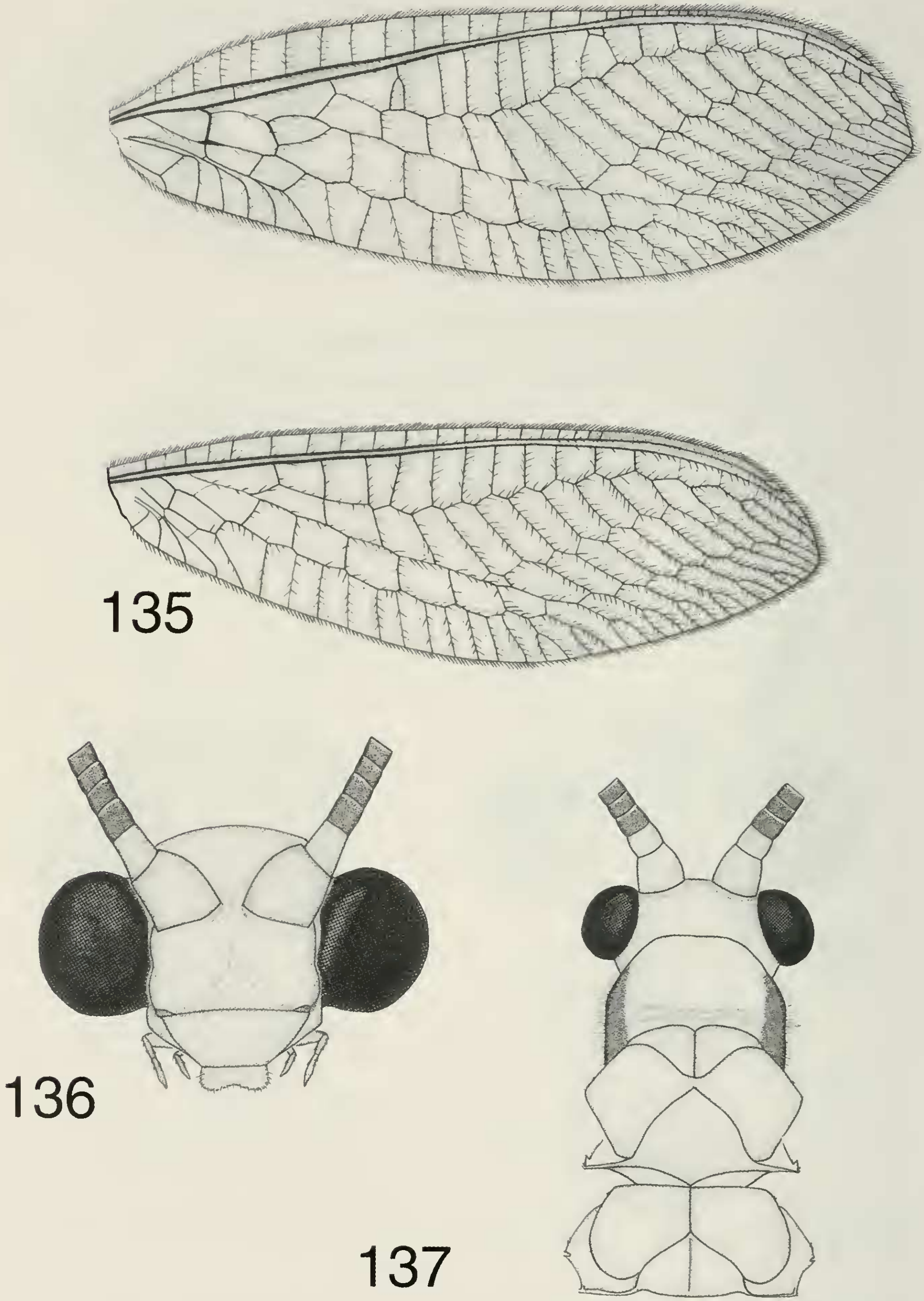
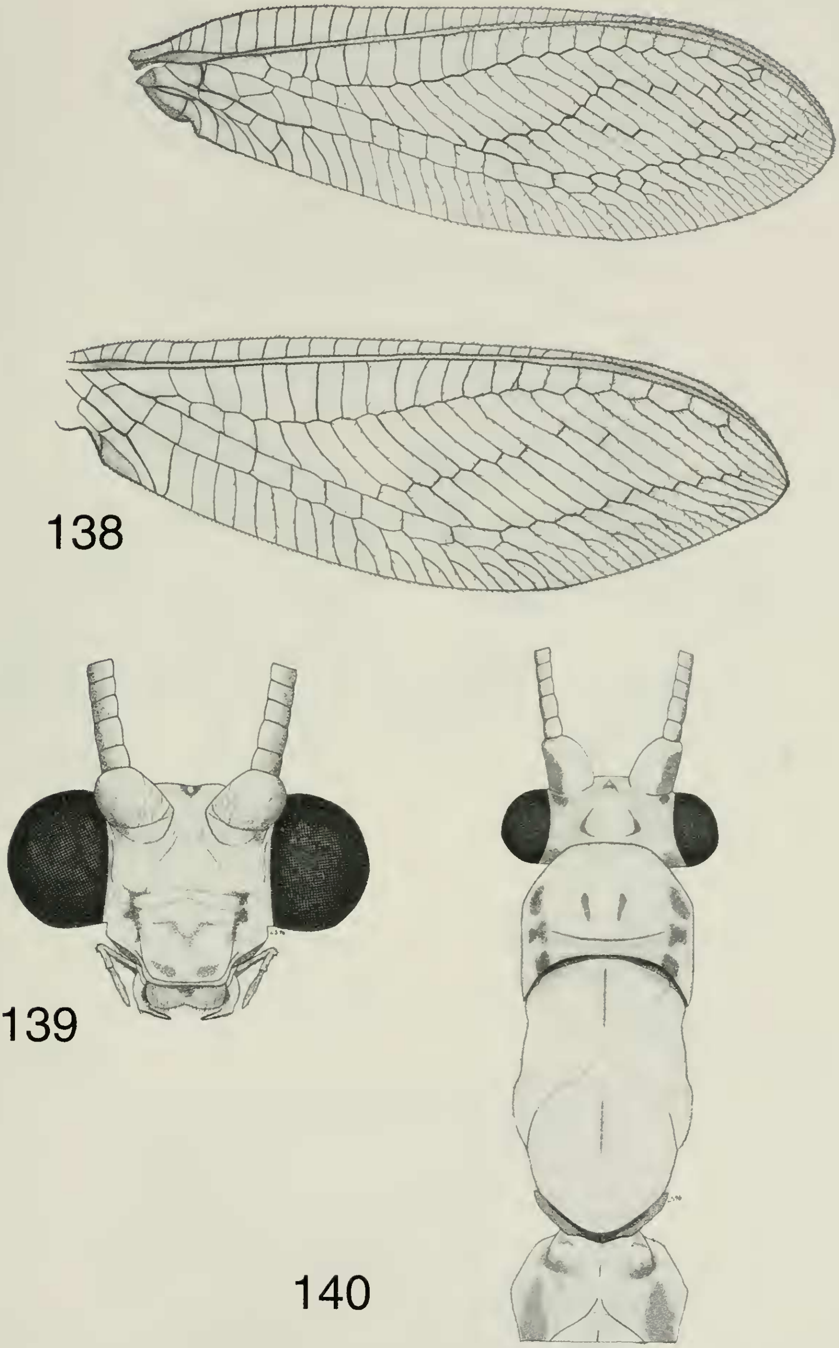
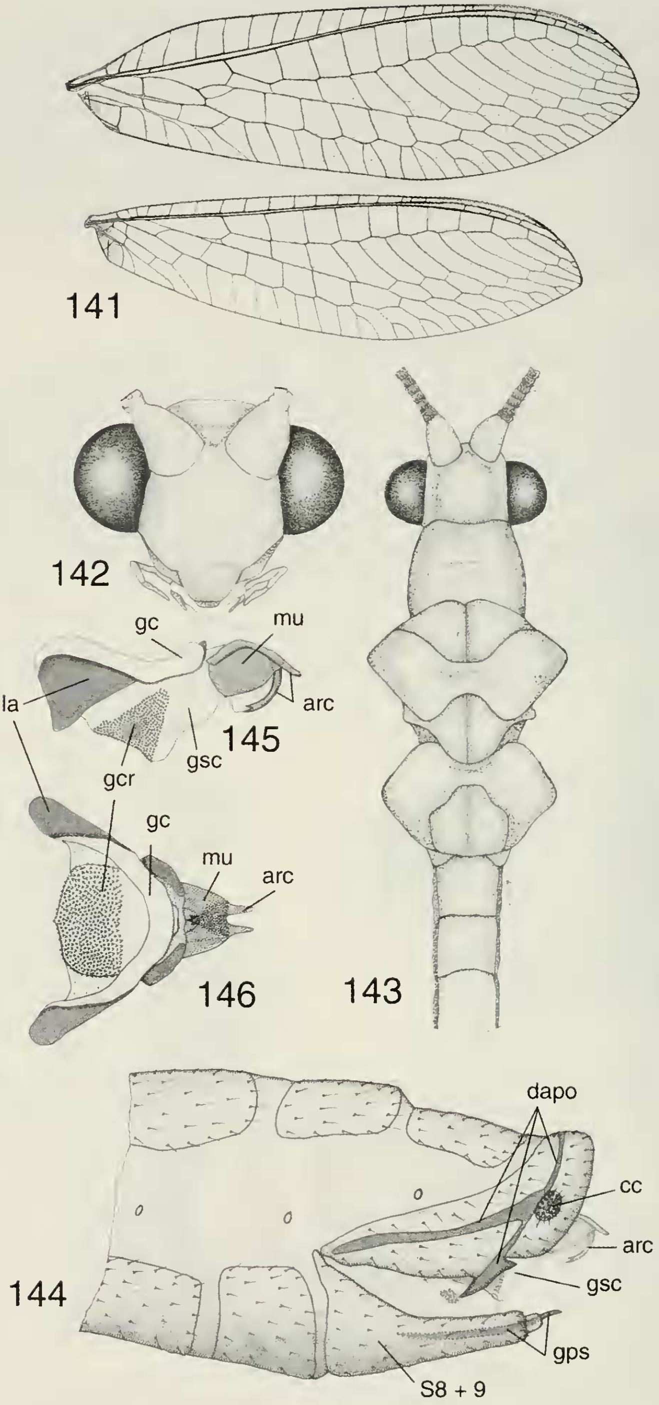
FIGURES 132–134. *Nacarina cordillera* (Banks). Fig. 132, right fore- and hind wings; Fig. 133, head in frontal view; Fig. 134, head and thorax in dorsal view. (Illustrations by Diane Wong)



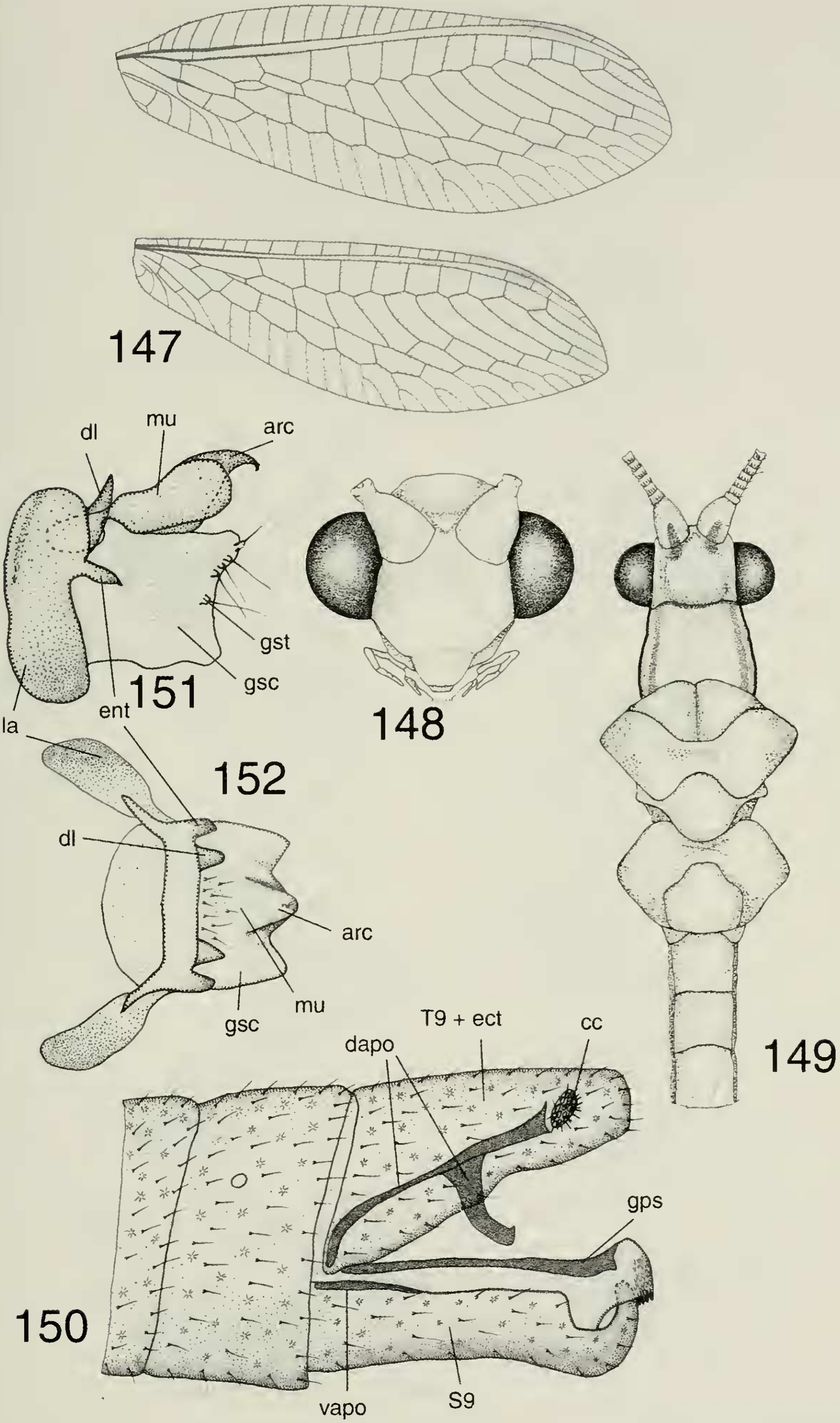
FIGURES 135–137. *Nacarina megaptera* (Navás). Fig. 135, right fore- and hind wings; Fig. 136, head in frontal view; Fig. 137, head and thorax in dorsal view. (Illustrations by Diane Wong)



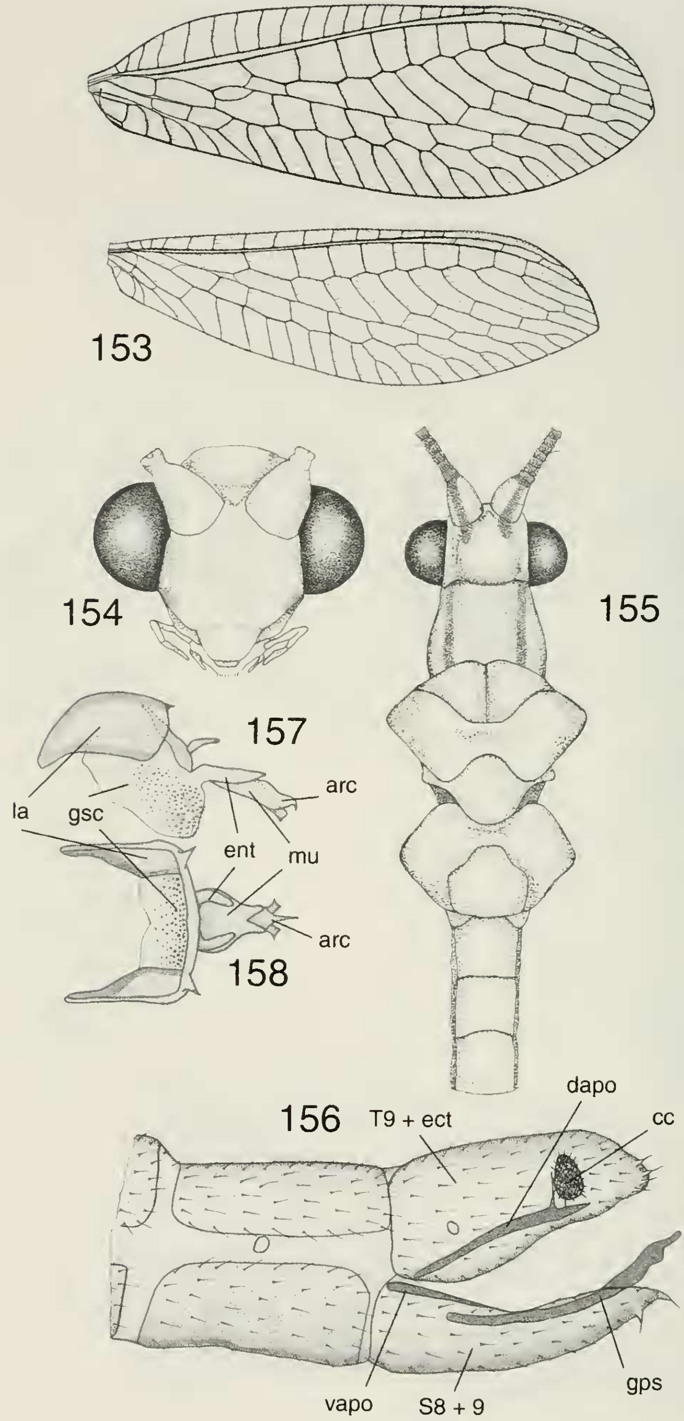
FIGURES 138–140. *Nacarina titan* (Banks). Fig. 138, right fore- and hind wings; Fig. 139, head in frontal view; Fig. 140, head and thorax in dorsal view. [Illustrations by Diane Wong (138) and Linda Seabrooks Campbell (139, 140)]



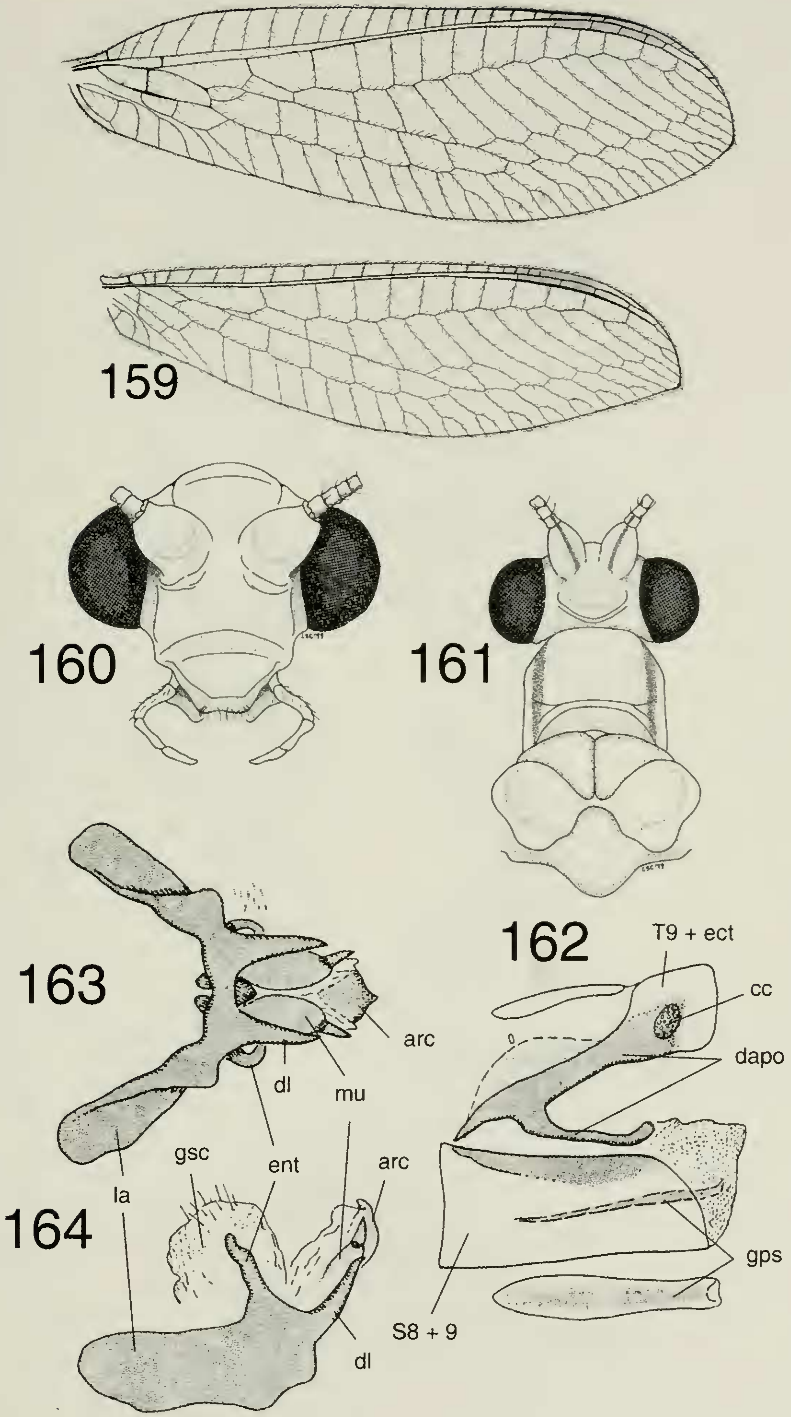
FIGURES 141–146. *Ceraeochrysa acmon* Penny. Fig. 141, right fore- and hind wings; Fig. 142, head in frontal view; Fig. 143, head and thorax in dorsal view; Fig. 144, male abdomen in lateral view; Fig. 145, male genitalia in lateral view; Fig 146, male genitalia in dorsal view. (Reprinted from Penny, 1998)



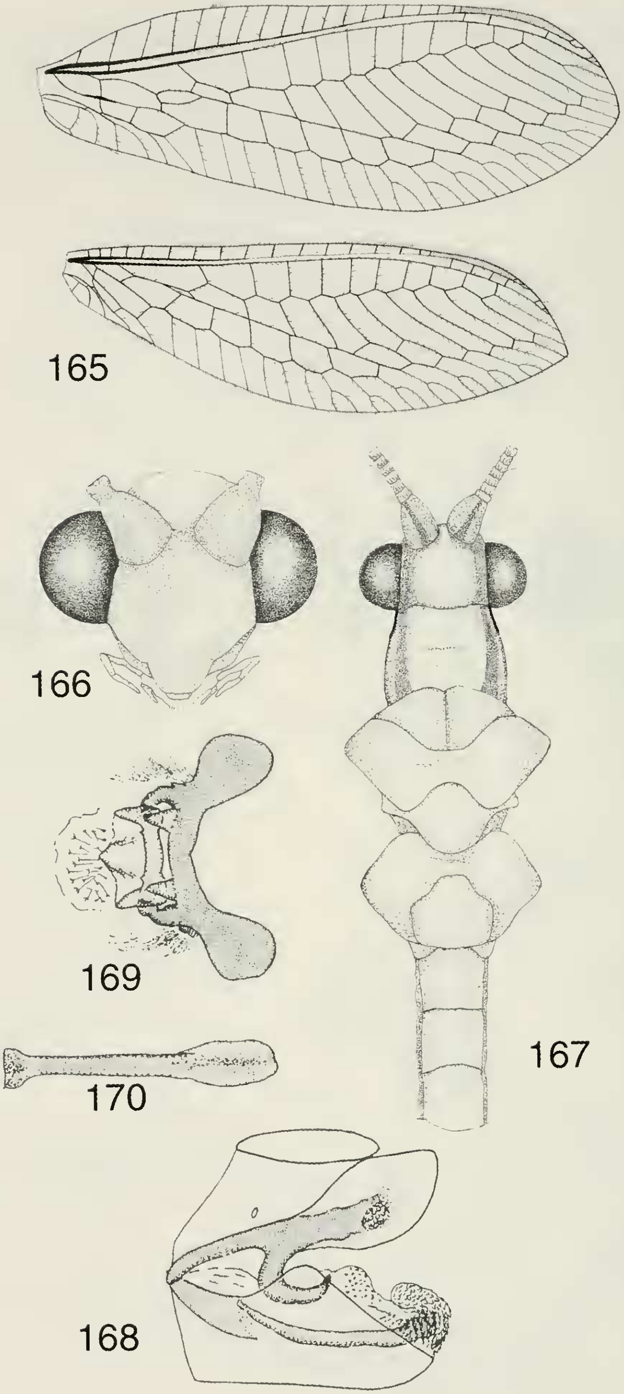
FIGURES 147–152. *Ceraeochrysa arioles* (Banks). Fig. 147, right fore- and hind wings; Fig. 148, head in frontal view; Fig. 149, head and thorax in dorsal view; Fig. 150, male abdomen in lateral view; Fig. 151, male genitalia, in dorsal view; fig. 152, male genitalia in lateral view. [Illustrations by Diane Wong (147), Barnaby Hall (148, 149), and Norman Penny (150–152)]



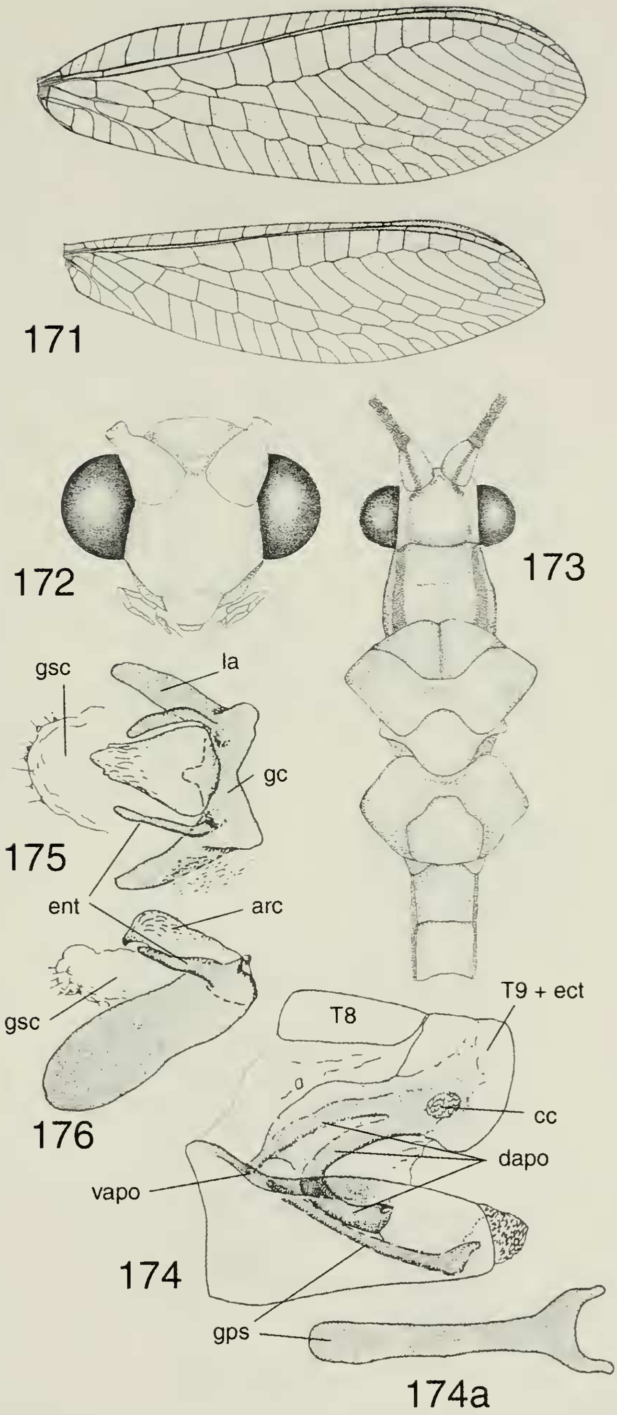
FIGURES 153–158. *Ceraeochrysa berlandi* (Navás). Fig. 153, right fore- and hind wings; Fig. 154, head in frontal view; Fig. 155, head and thorax in dorsal view; Fig. 156, male abdomen in lateral view; Fig. 157, male genitalia in lateral view; Fig. 158, male genitalia in dorsal view. [Illustrations by Virginia Kirsch (153), Barnaby Hall (154, 155), and Norman Penny (156–158)]



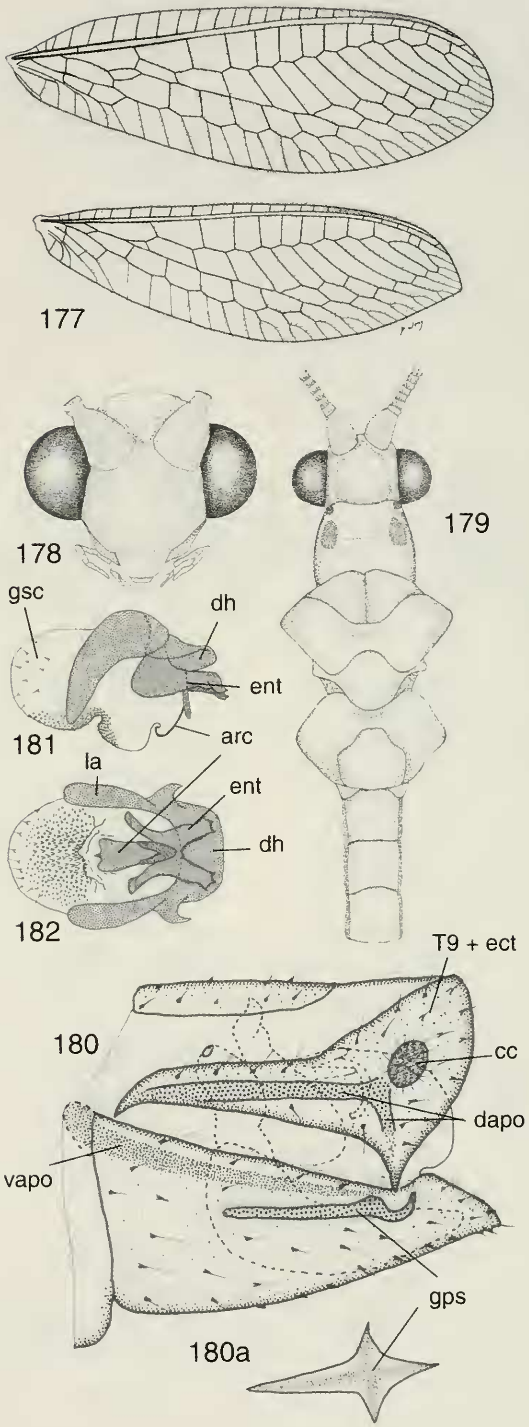
FIGURES 159–164. *Ceraeochrysa caligata* (Banks). Fig. 159, right fore- and hind wings; Fig. 160, head in frontal view; Fig. 161, head and thorax in dorsal view; Fig. 162, male abdomen in lateral view; Fig. 163, male genitalia in dorsal view; Fig. 164, male genitalia in lateral view. [Illustrations by Linda Seabrooks Campbell (159–161), and reprinted from Adams & Penny (1987) (162–164)]



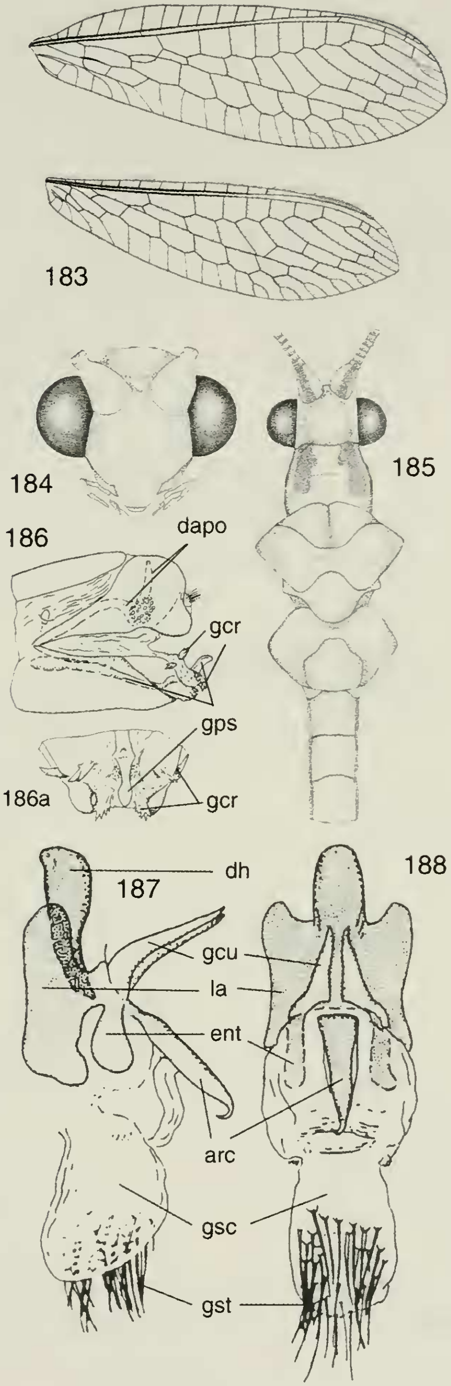
FIGURES 165–170. *Ceraeochrysa cincta* (Schneider). Fig. 165, right fore- and hind wings; Fig. 166, head in frontal view; Fig. 167, head and thorax in dorsal view; Fig. 168, male abdomen in lateral view; Fig. 169, male genitalia in dorsal view; Fig. 170, male gonapsis in lateral view. [Illustrations by Diane Wong (165), Barnaby Hall (166, 167), and reprinted from Adams and Penny (1987) (168–170)]



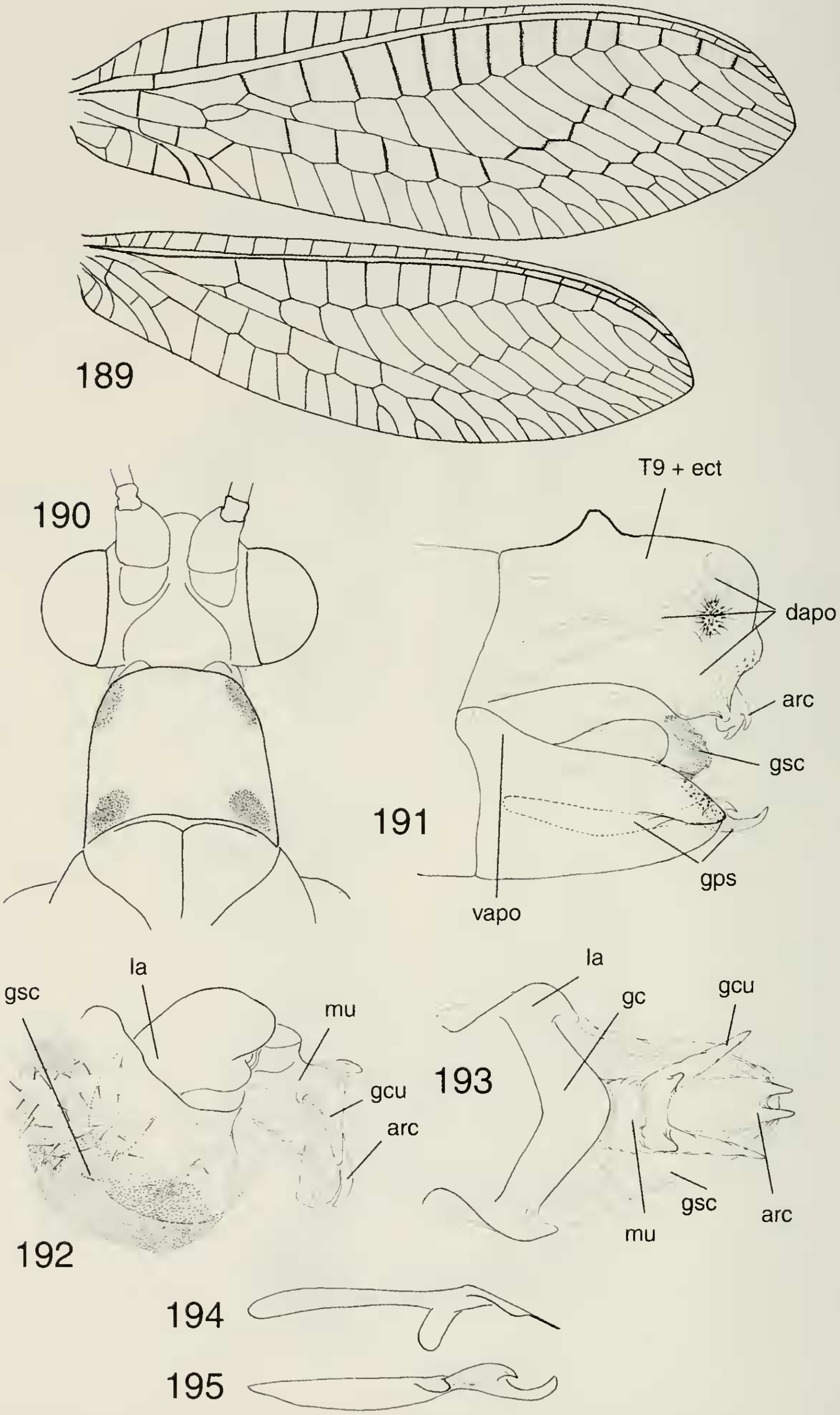
FIGURES 171–176. *Ceraeochrysa claveri* (Navás). Fig. 171, right fore- and hind wings; Fig. 172, head in frontal view; Fig. 173, head and thorax in dorsal view; Fig. 174, male abdomen in lateral view; Fig. 174a, male gonapsis in dorsal view; Fig. 175, male genitalia in dorsal view; Fig. 176, male genitalia in lateral view. [Illustrations by Virginia Kirsch (171), Barnaby Hall (172, 173), and reprinted from Adams and Penny (1987) (174–176)]



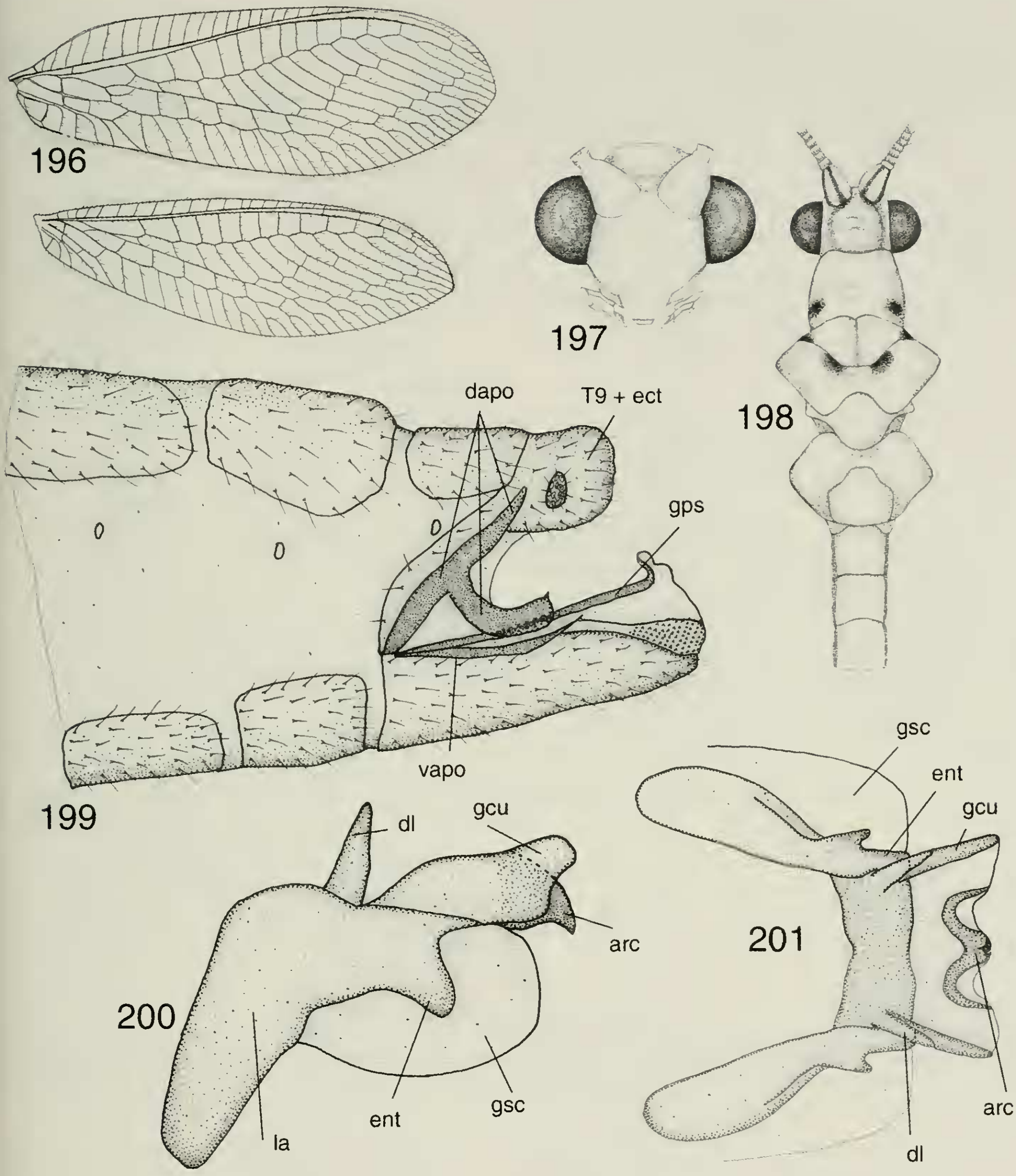
FIGURES 177–182. *Ceraeochrysa costaricensis* Penny. Fig. 177, right fore- and hind wings; Fig. 178, head in frontal view; Fig. 179, head and thorax in dorsal view; Fig. 180, male abdomen in lateral view; Fig. 181, male genitalia in lateral view; Fig. 181a, male gonapsis in dorsal view; Fig. 182, male genitalia in dorsal view. (Reprinted from Penny, 1997)



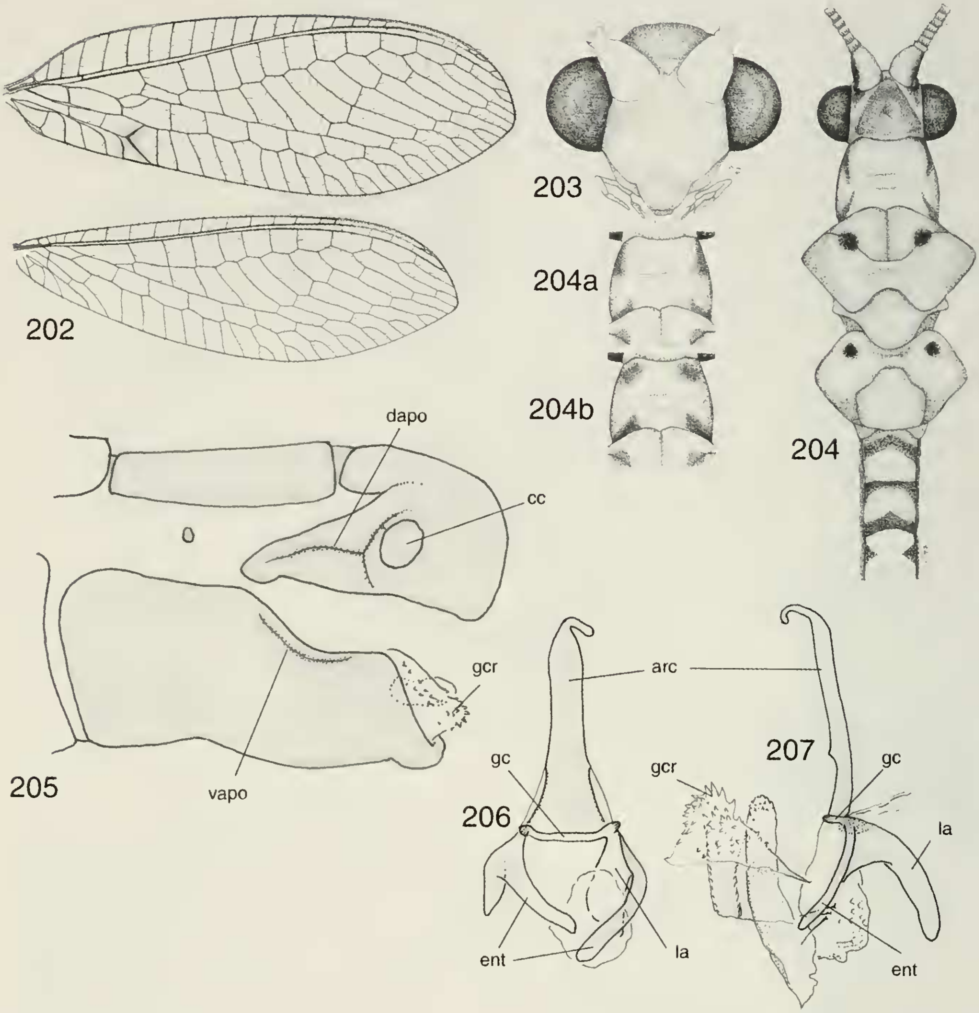
FIGURES 183–188. *Ceraeochrysa cubana* (Hagen). Fig. 183, right fore- and hind wings; Fig. 184, head in frontal view; Fig. 185, head and thorax in dorsal view; Fig. 186, male abdomen in lateral view; Fig. 187, male genitalia in lateral view; Fig. 188, male genitalia in dorsal view. [Illustrations by Diane Wong (183), Barnaby Hall (184, 185), and reprinted from Adams & Penny (1987) (186–188)]



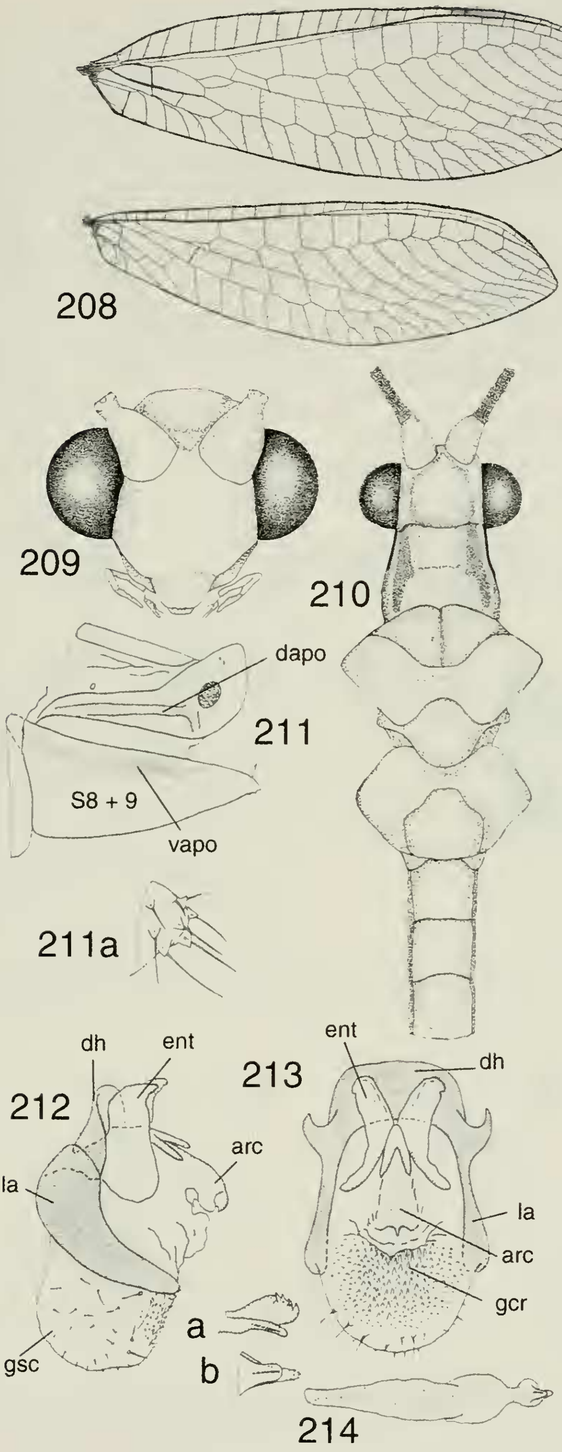
FIGURES 189–195. *Ceraeochrysa defreitasi* Penny, new species. Fig. 189, right fore- and hind wings; Fig. 190, head and thorax in dorsal view; Fig. 191, apex of abdomen in lateral view; Fig. 192, male genitalia in lateral view, Fig. 193, male genitalia in dorsal view; Fig. 194, gonapsis in dorsal view, Fig. 195, gonapsis in lateral view. (Illustrations by Norman Penny)



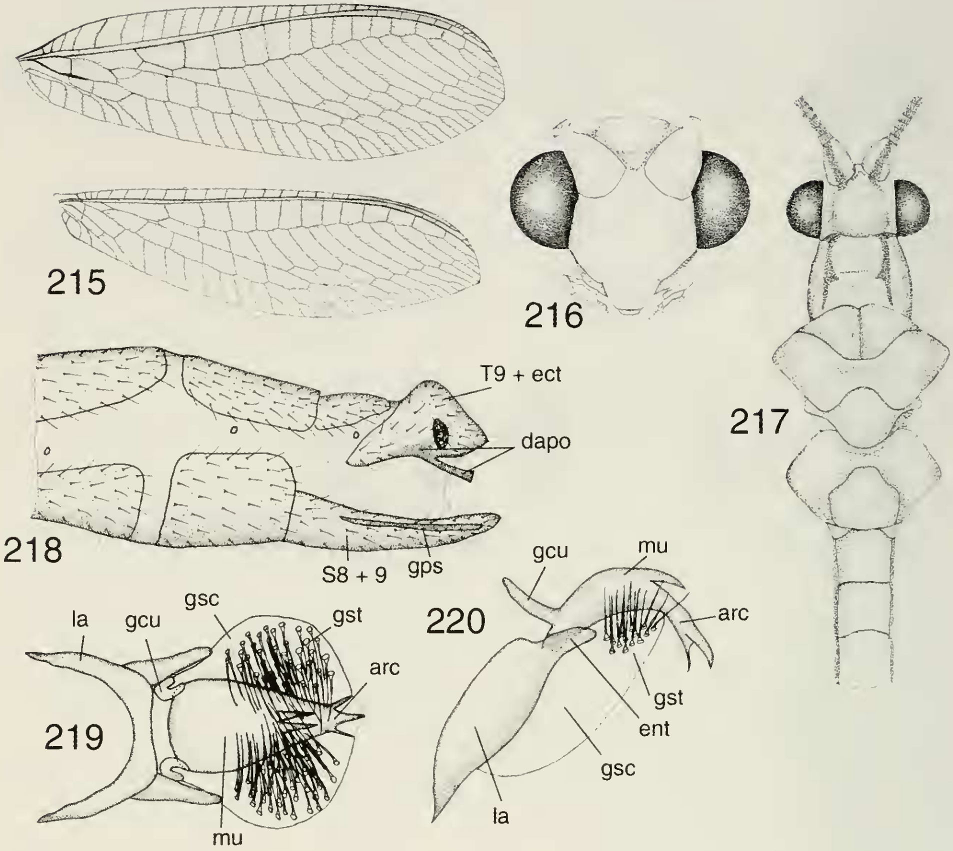
FIGURES 196–201. *Ceraeochrysa discolor* (Navás). Fig. 196, right fore- and hind wings; Fig. 197, head in frontal view; Fig. 198, head and thorax in dorsal view; Fig. 199, male abdomen in lateral view; Fig. 200, male genitalia in lateral view; Fig. 201, male genitalia in dorsal view. [Illustrations by Virginia Kirsch (196), Victoria Saxe (197, 198), and Norman Penny (199–201)]



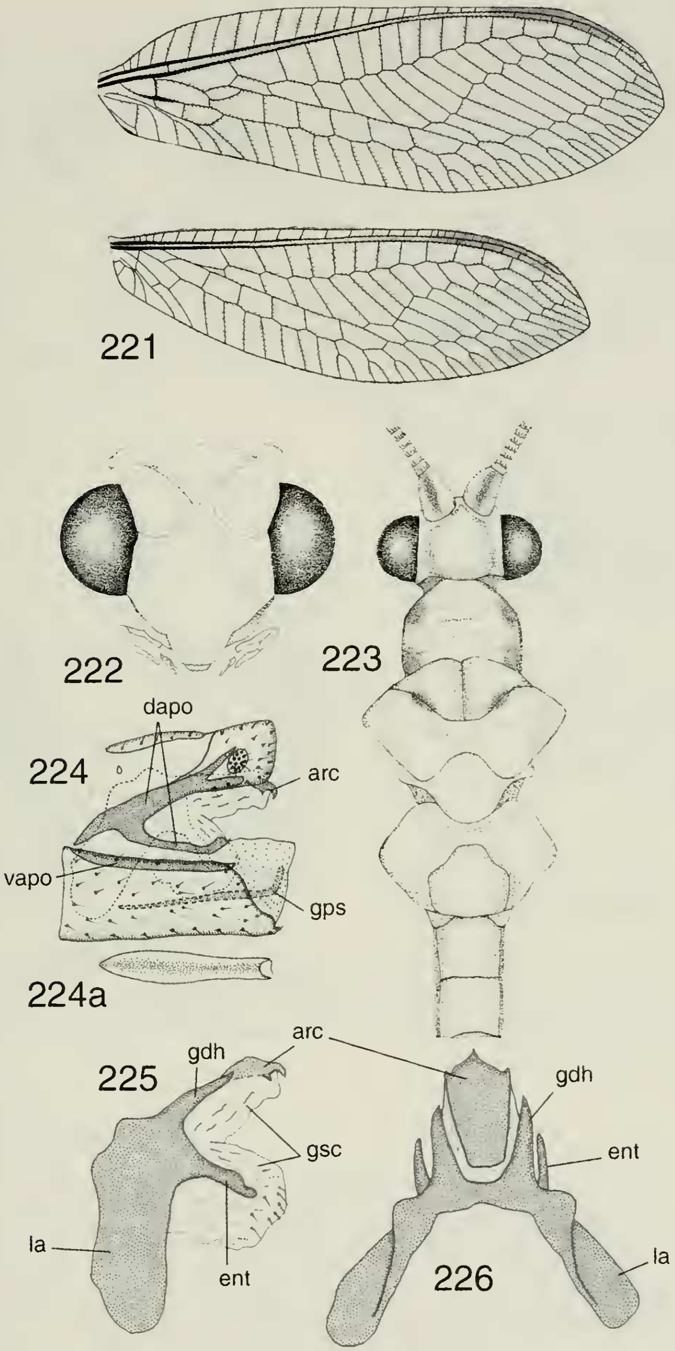
Figures 202–207. *Ceraeochrysa elegans* Penny. Fig. 202, right fore- and hind wings; Fig. 203, head in frontal view; Fig. 204, head and thorax in dorsal view; Figs. 204 a, b, pronotum in dorsal view (variations); Fig. 205, male abdomen in lateral view; Fig. 206, male genitalia in ventral view; Fig. 207, male genitalia in lateral view. (Reprinted from Penny, 1998)



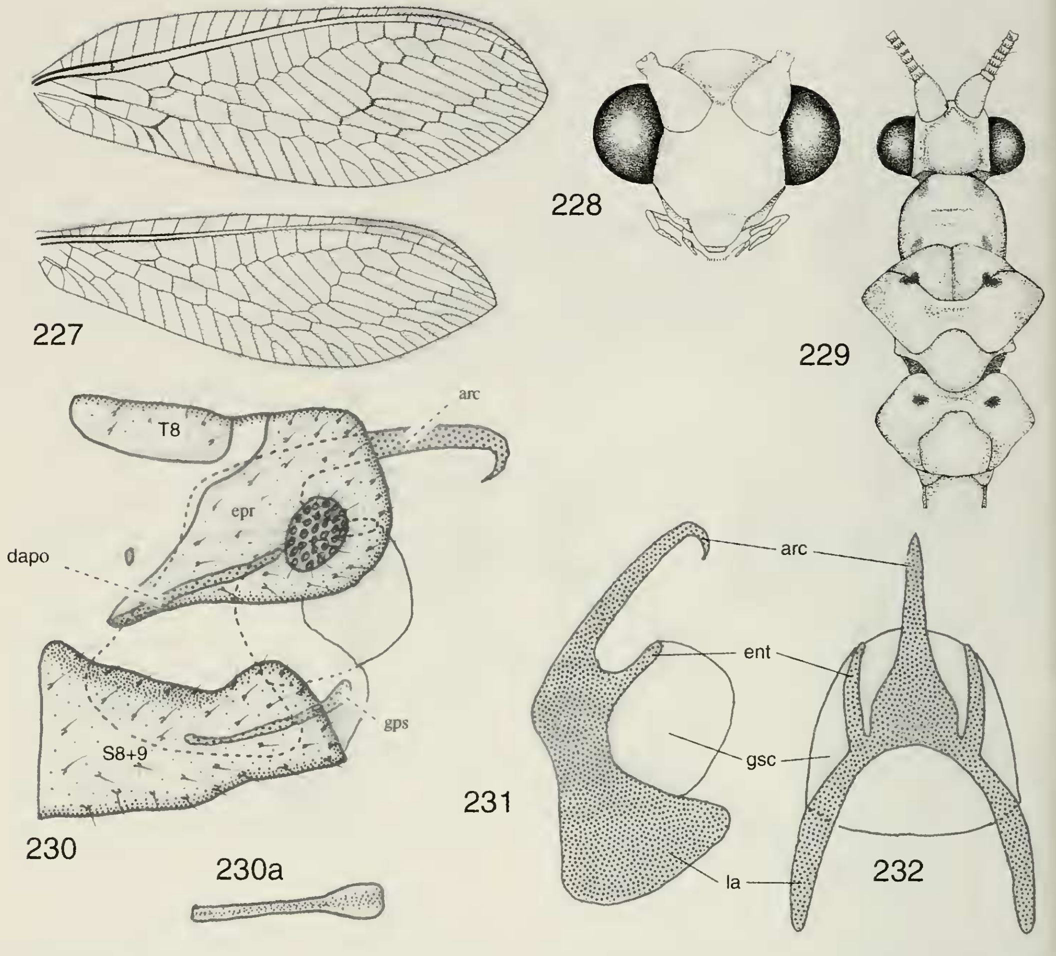
FIGURES 208–214. *Ceraeochrysa everes* (Banks). Fig. 208, right fore- and hind wings; Fig. 209, head in frontal view; Fig. 210, head and thorax in lateral view; Fig. 211, male abdomen in lateral view; Fig. 211a, apex of male ninth sternum in lateral view, Fig. 212, male genitalia in lateral view; Fig. 213, male genitalia in dorsal view; Fig. 214, male gonapsis in dorsal view; 214a, in lateral view; 214b, in ventral view. [Illustrations by Diane T. Sands (208), Barnaby Hall (209, 210), and reprinted from Adams and Penny (1987) (211–214)]



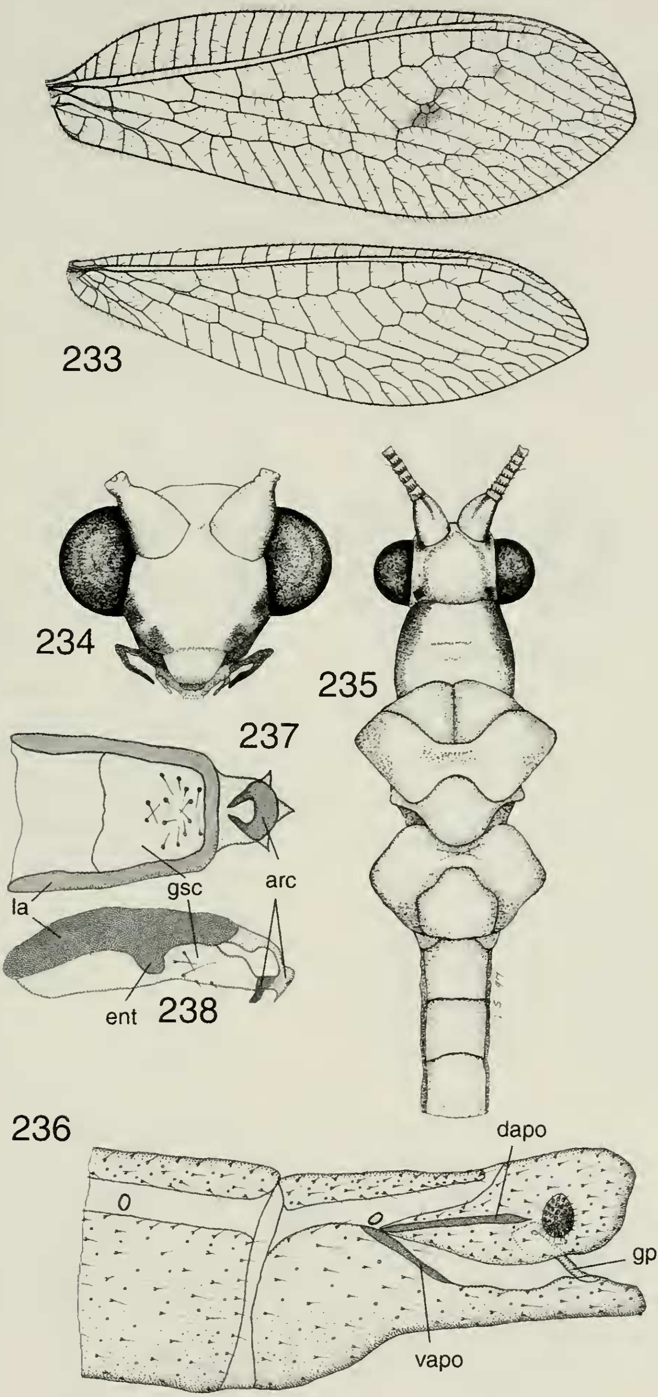
FIGURES 215–220. *Ceraeochrysa gradata* (Navás). Fig. 215, right fore- and hind wings; Fig. 216, head in frontal view; Fig. 217, head and thorax in dorsal view; Fig. 218, male abdomen in lateral view; Fig. 219, male genitalia in dorsal view; Fig. 220, male genitalia in lateral view. [Illustrations by Linda Seabrooks Campbell (215), Barnaby Hall (216, 217), and Norman Penny (218–220)]



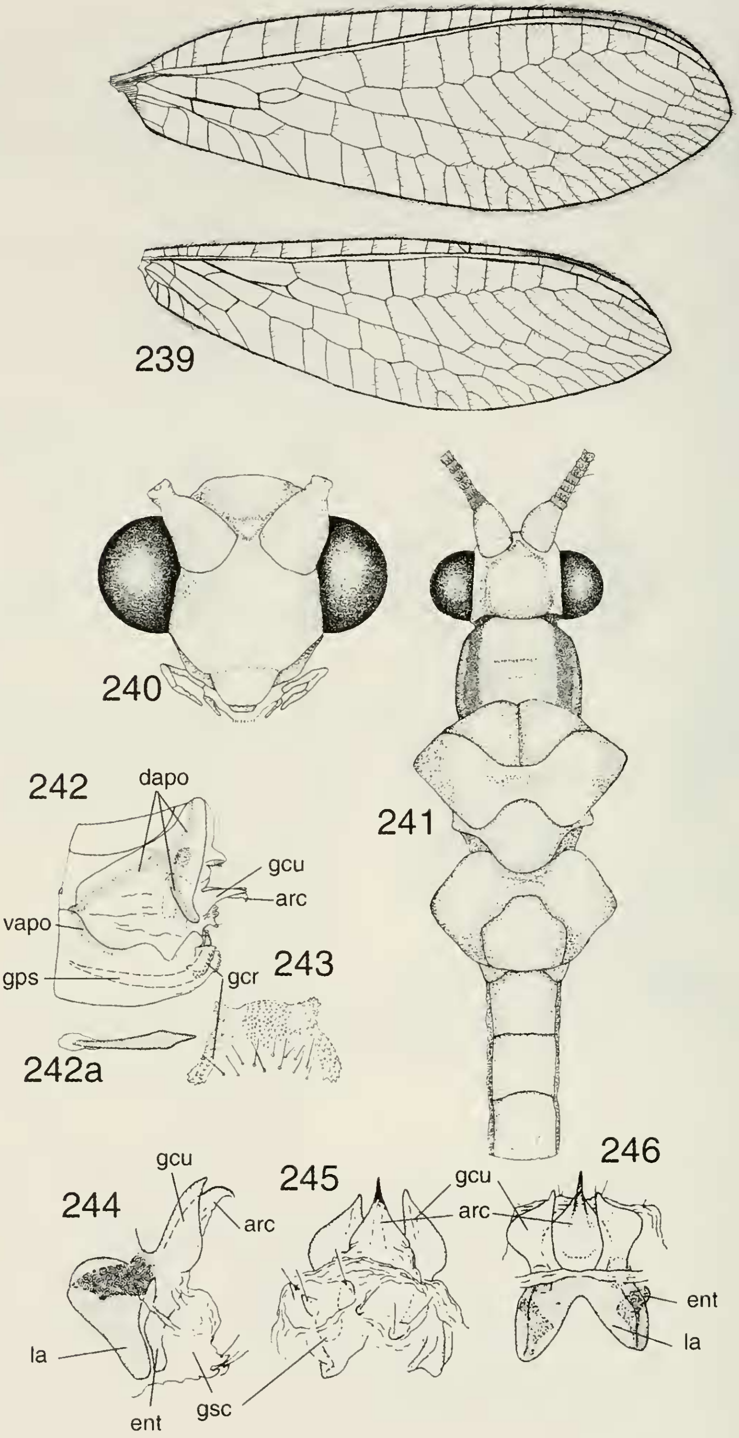
Figures 221–226. *Ceraeochrysa inbio* Penny. Fig. 221, right fore- and hind wings; Fig. 222, head in frontal view; Fig. 223, head and thorax in dorsal view; Fig. 224, male abdomen in lateral view; Fig. 224a, gonapsis in dorsal view; Fig. 225, male genitalia in lateral view; Fig. 226, male genitalia in dorsal view. (Reprinted from Penny, 1997)



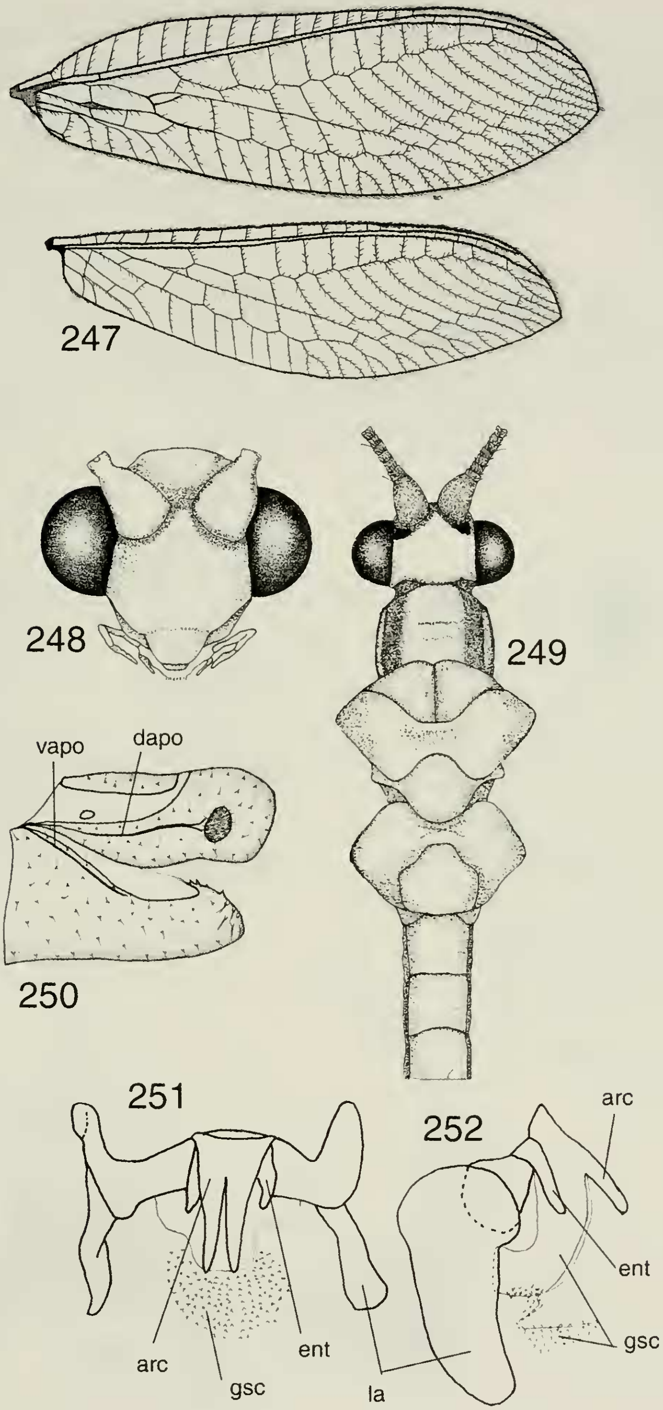
FIGURES 227–232. *Ceraeochrysa nigripedis* Penny. Fig. 227, right fore- and hind wings; Fig. 228, head in frontal view; Fig. 229, head and thorax in dorsal view; Fig. 230, male abdomen in lateral view; Fig. 230a, gonapsis, in dorsal view; Fig. 231, male genitalia in lateral view; Fig. 232, male genitalia in dorsal view. apo = dorsal apodeme, arc = arcessus, epr = ectoproct, gps = gonapsis. (Reprinted from Penny, 1997)



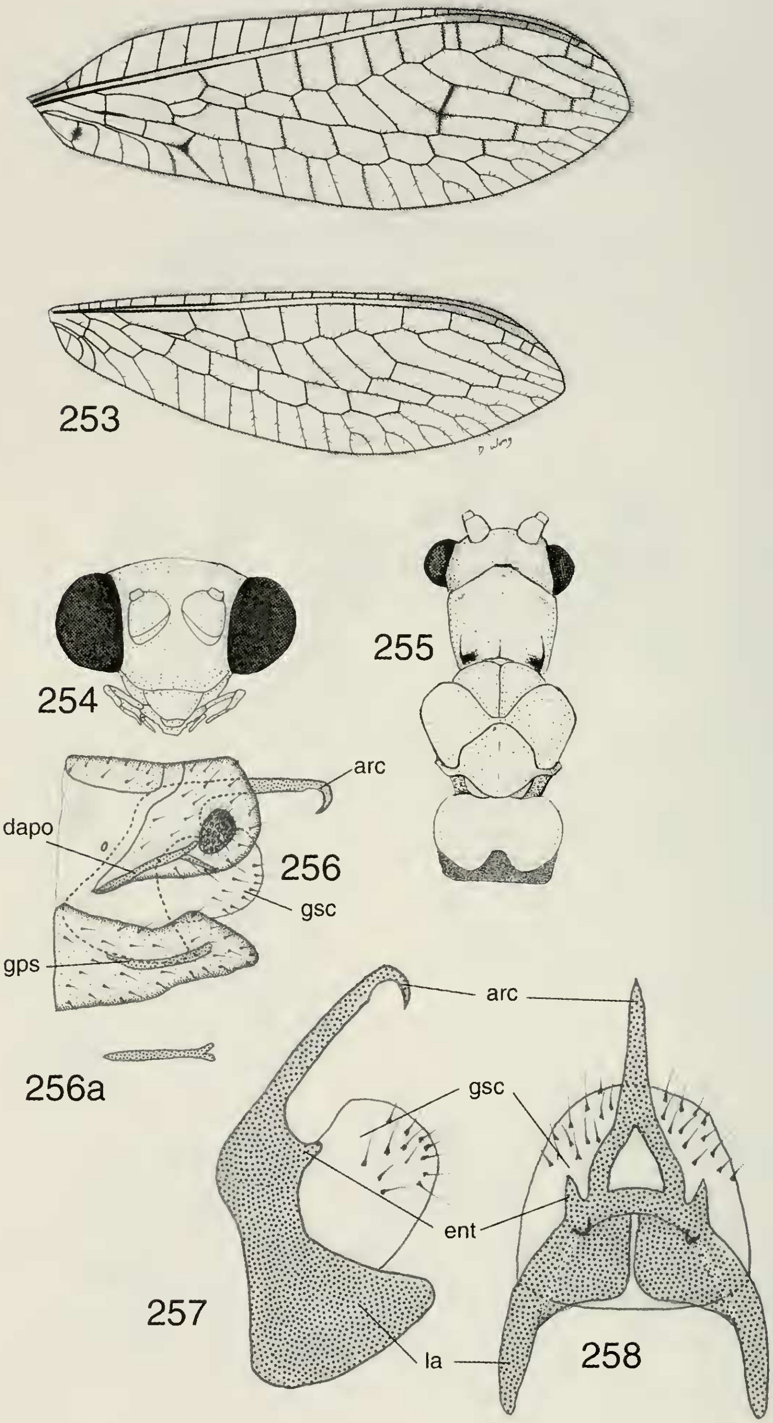
FIGURES 233–238. *Ceraeochrysa pseudovaricosa* Penny. Fig. 233, right fore- and hind wings; Fig. 234, head in frontal view; Fig. 235, head and thorax in dorsal view; Fig. 236, male abdomen in lateral view; Fig. 237, male genitalia in dorsal view; Fig. 231, male genitalia in lateral view. (Reprinted from Penny, 1998)



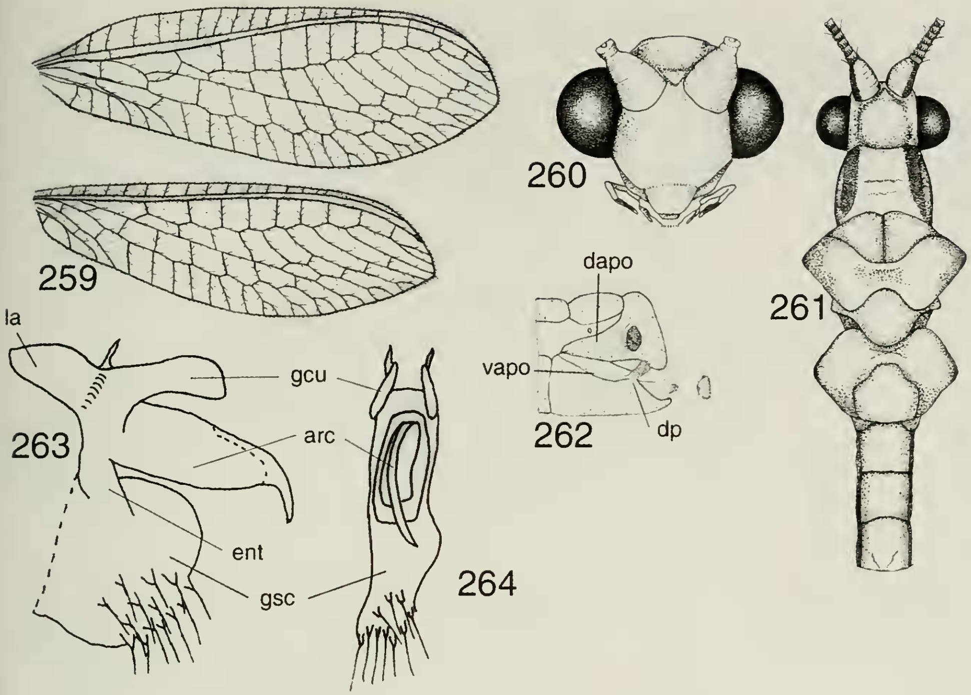
FIGURES 239–246. *Ceraeochrysa sanchezi* (Navás). Fig. 239, right fore- and hind wings; Fig. 240, head in frontal view; Fig. 241, head and thorax in dorsal view; Fig. 242, male abdomen in lateral view; 242a, gonapsis in dorsal view; Fig. 243, male apex of sternite 9; Fig. 244, male genitalia in lateral view; Fig. 245, male genitalia in ventral view; Fig. 246, male genitalia in dorsal view. [Illustrations by Diane T. Sands (239), Barnaby Hall (240, 241), and reprinted from Adams and Penny (1987) (242–246)]



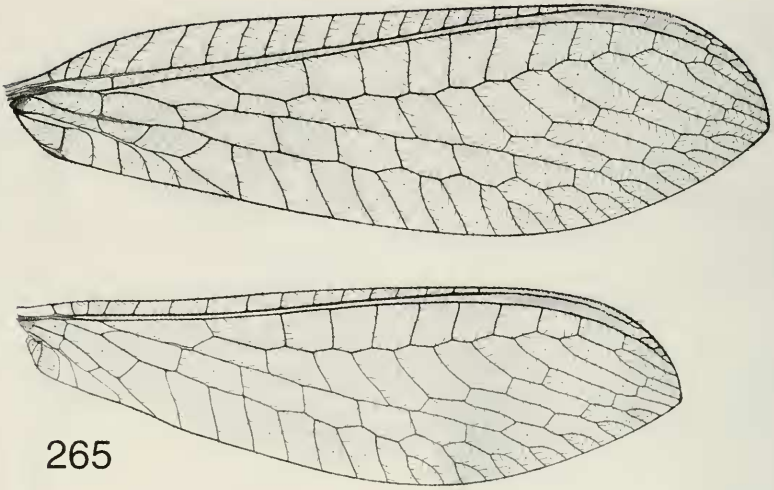
FIGURES 247–252. *Ceraeochrysa smithi* (Navás). Fig. 247, right fore- and hind wings; Fig. 248, head in frontal view; Fig. 249, head and thorax in lateral view; Fig. 250, male abdomen in lateral view; Fig. 251, male genitalia in dorsal view; Fig. 252, male genitalia in lateral view. [Illustrations by Diane T. Sands (247), Barnaby Hall (248, 249), and Norman Penny (250–252)]



FIGURES 253–258. *Ceraeochrysa tauberae* Penny. Fig. 253, right fore- and hind wings; Fig. 254, head in frontal view; Fig. 255, head and thorax in lateral view; Fig. 256, male abdomen in lateral view; Fig. 256a, gonapsis in dorsal view; Fig. 257, male genitalia in dorsal view; Fig. 258, male genitalia in lateral view. (Reprinted from Penny, 1997)



FIGURES 259–264. *Ceraeochrysa valida* (Banks). Fig. 259, right fore- and hind wings; Fig. 260, head in frontal view; Fig. 261, head and thorax in dorsal view; Fig. 262, male abdomen in lateral view; Fig. 263, male genitalia in lateral view; Fig. 264, male genitalia in caudal view. (Illustrations by Norman Penny)



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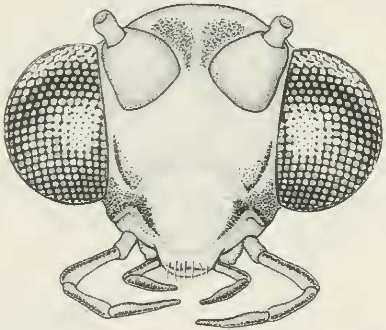

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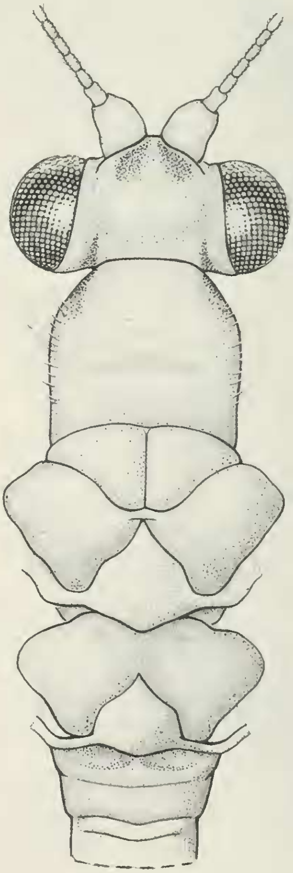

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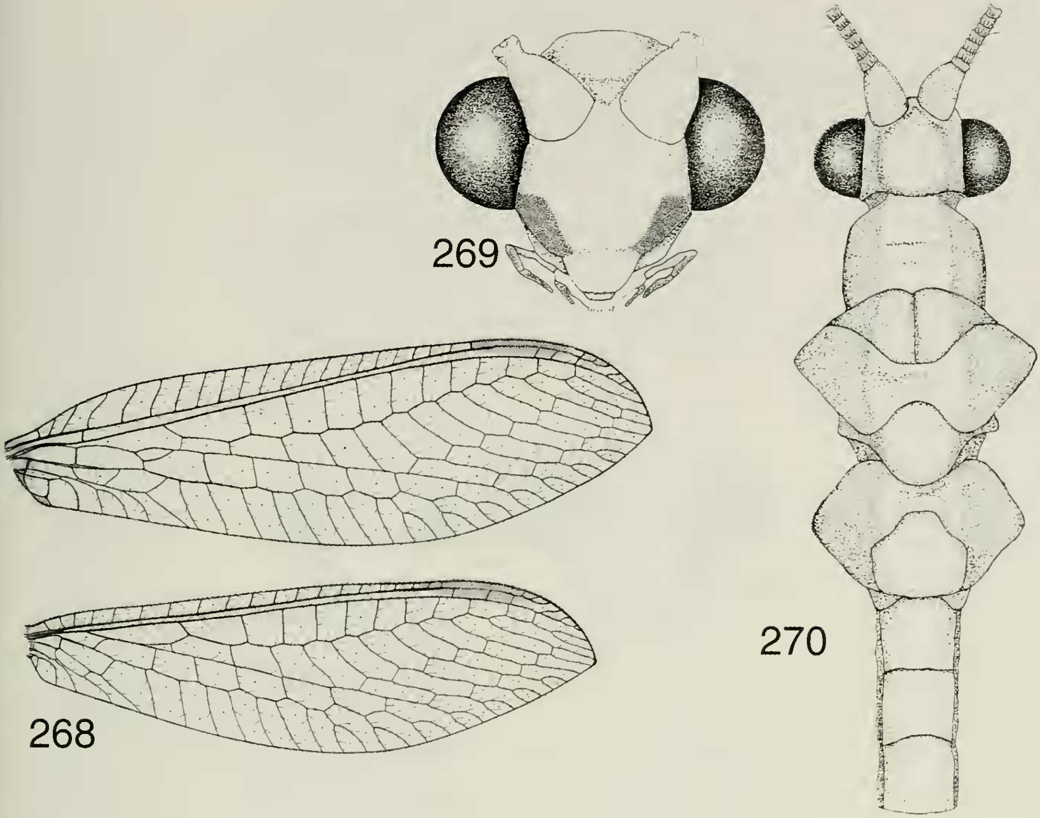
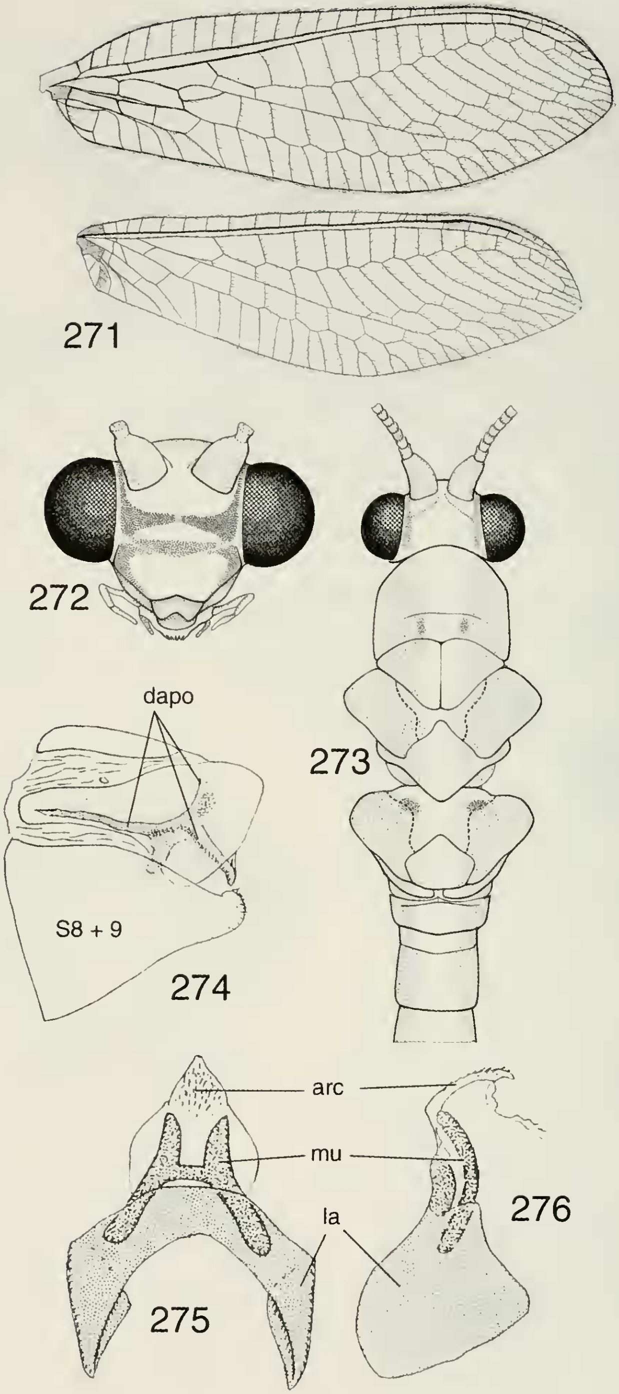
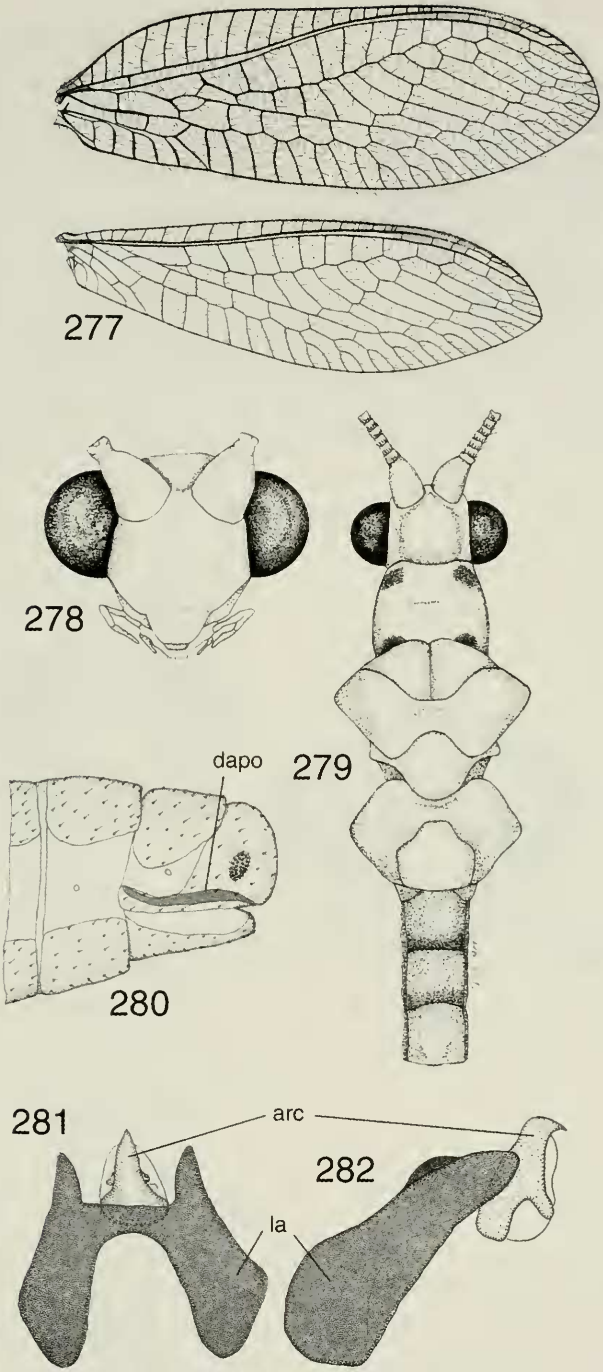
FIGURES 265–267. *Chrysoperla exotera* (Navás). Fig. 265, right fore- and hind wings; Fig. 266, head in frontal view; Fig. 267, head and thorax in dorsal view. (Illustrations by Virginia Kirsch)



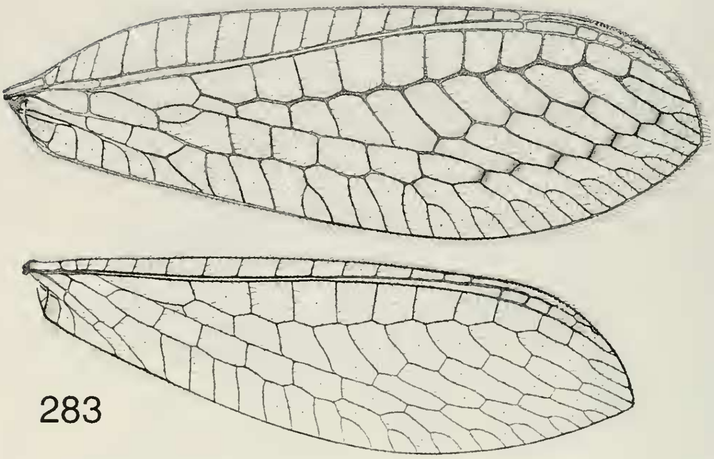
FIGURES 268–270. *Chrysoperla externa* (Hagen). Fig. 268, right fore- and hind wings; Fig. 269, head in frontal view; Fig. 270, head and thorax in dorsal view. [Illustrations by Virginia Kirsch (268) and Barnaby Hall (269, 270)]



FIGURES 271–276. *Chrysopodes* (*Neosuarius*) *collaris* (Schneider). Fig. 271, right fore- and hind wings; Fig. 272, head in frontal view; Fig. 273, head and thorax in dorsal view; Fig. 274, male abdomen in lateral view; Fig. 275, male genitalia in dorsal view; Fig. 276, male genitalia in lateral view. [Illustrations by Diane T. Sands (271), Virginia Kirsch (272, 273), and reprinted from Adams and Penny (1987) (274–276)]



FIGURES 277–282. *Chrysopodes* (*Neosuarius*) *crassinervis* Penny. Fig. 277, male right fore- and hind wings; Fig. 278, head in frontal view; Fig. 279, head and thorax in dorsal view; Fig. 280, male abdomen in lateral view; Fig. 281, male genitalia in dorsal view; Fig. 282, male genitalia in lateral view. (Reprinted from Penny, 1998)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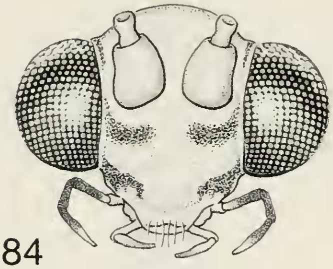
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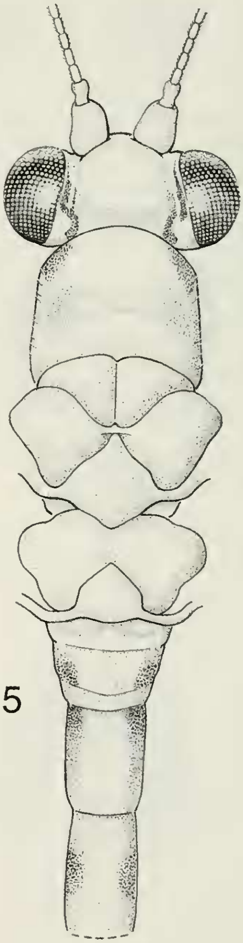
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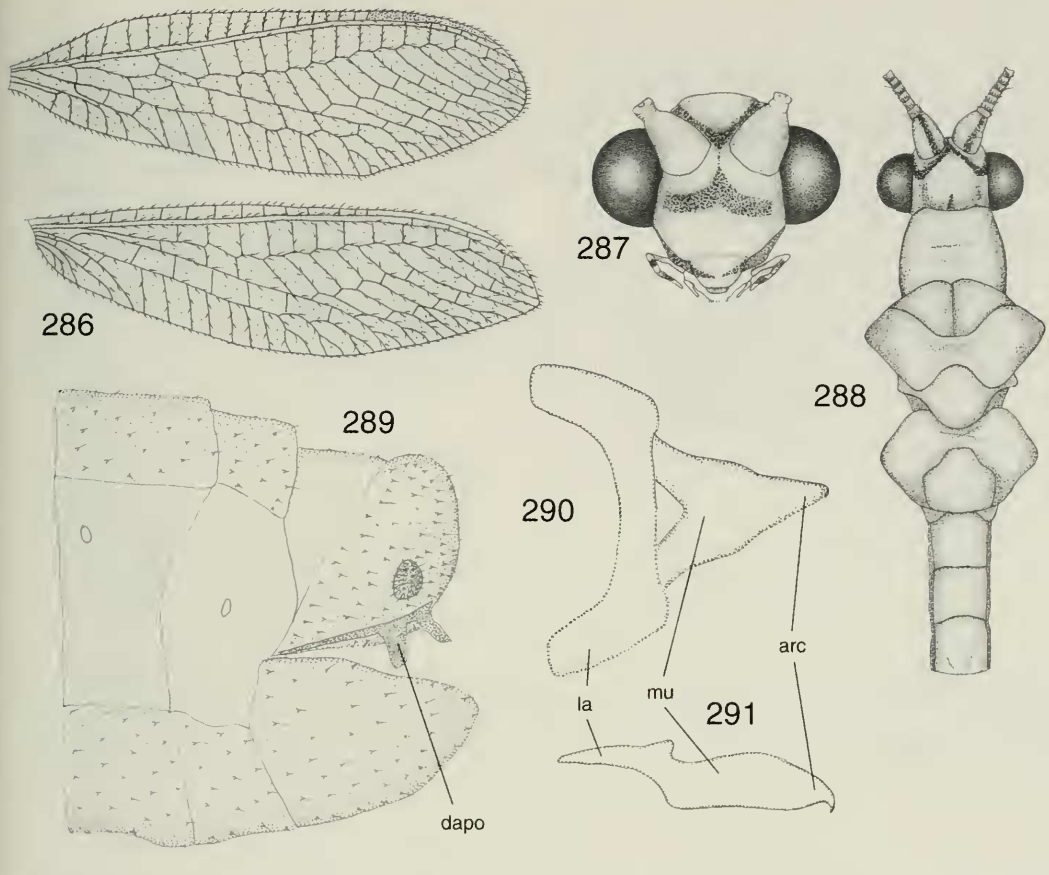
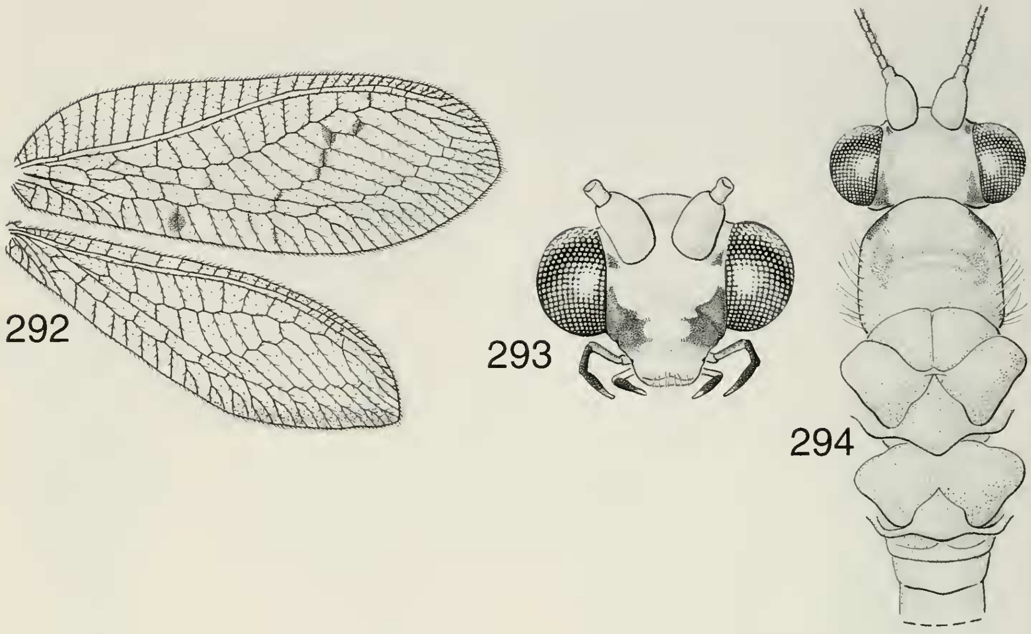
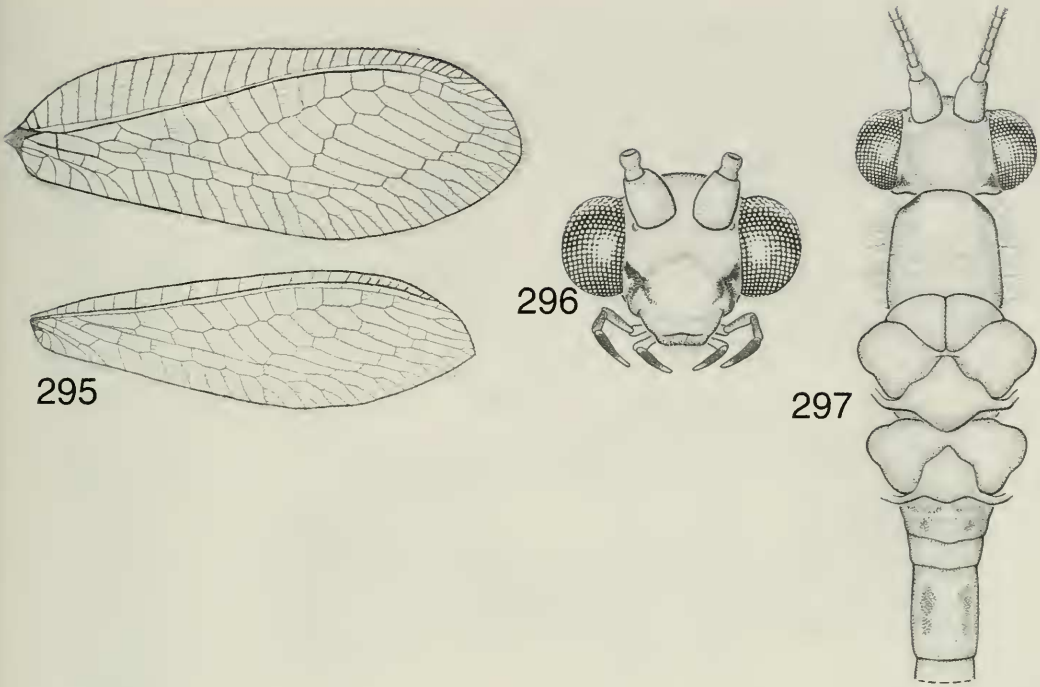
FIGURES 283–285. *Chrysopodes* (*Neosuarius*) *crassipennis* Penny. Fig. 283, male right fore- and hind wings; Fig. 284, head in frontal view; Fig. 285, head and thorax in dorsal view. (Reprinted from Penny, 2001)



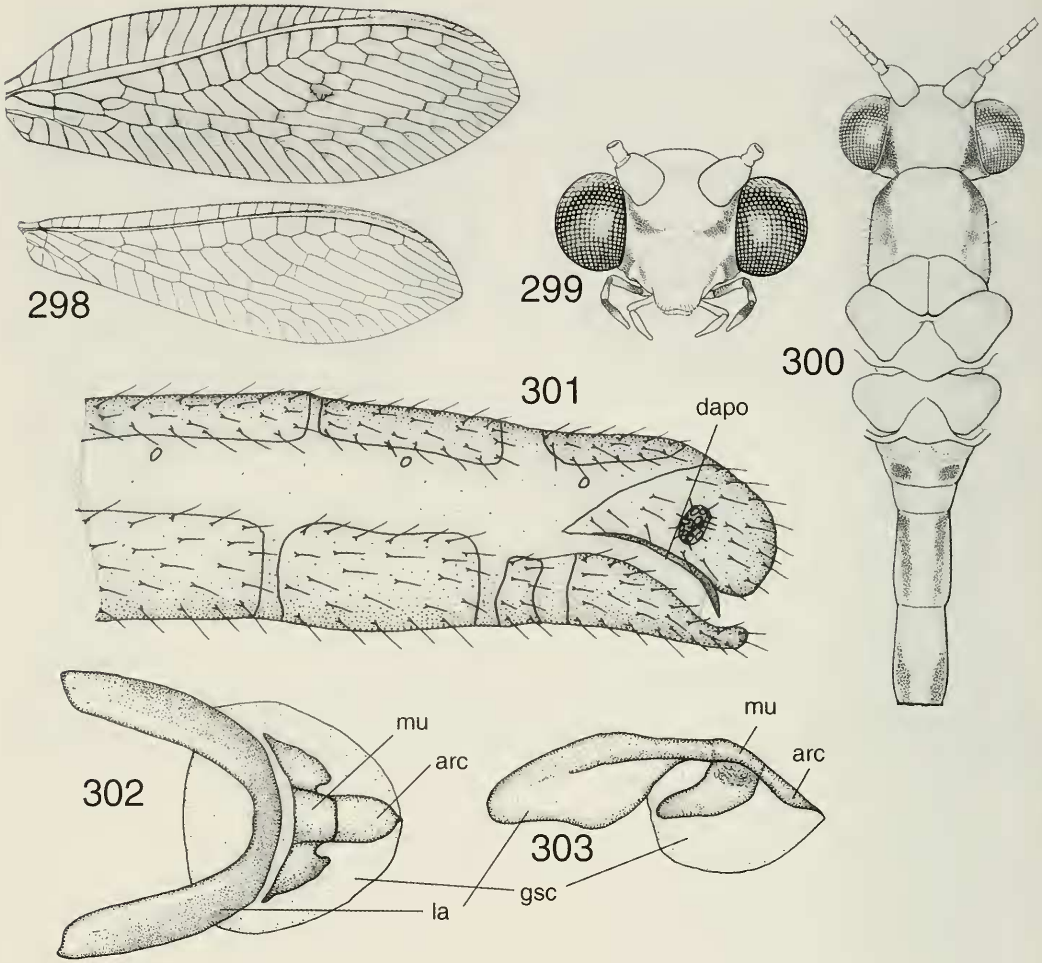
FIGURES 286–291. *Chrysopodes* (*Neosuarius*) *oswaldi* Penny, new species. Fig. 284, right fore- and hind wings; Fig. 287, head in frontal view; Fig. 288, head, thorax, and base of abdomen in dorsal view; Fig. 289, apex of abdomen in lateral view; Fig. 290, male genitalia in dorsal view; Fig. 291, male genitalia in lateral view. (Illustrations by Norman Penny)



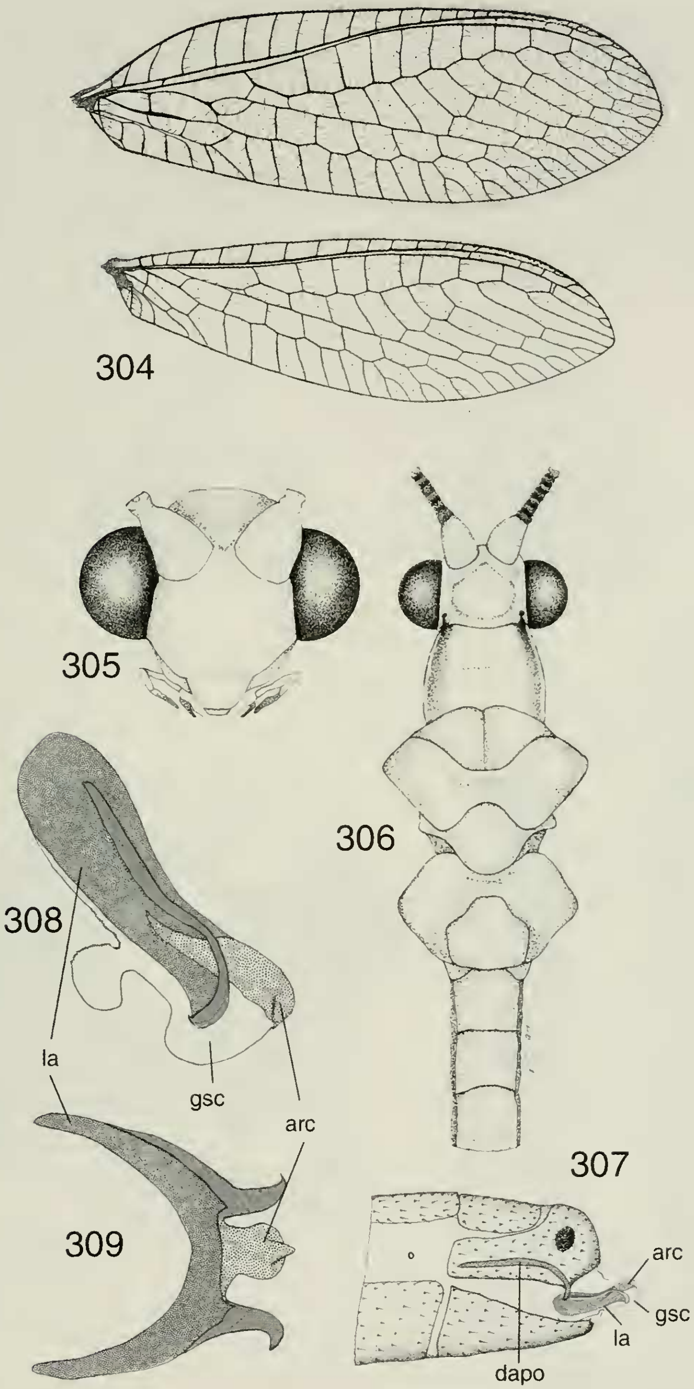
FIGURES 292–294. *Chrysopodes* (*Chrysopodes*) *costalis* (Schneider). Fig. 292, right fore- and hind wings; Fig. 293, head in frontal view; Fig. 294, head and thorax in dorsal view. [Illustrations by Norman Penny (292) and Virginia Kirsch (293, 294)]



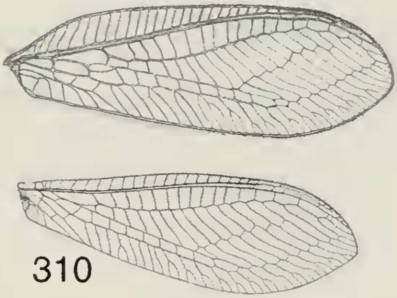
FIGURES 295–297. *Chrysopodes* (*Chrysopodes*) *nevermanni* (Navás). Fig. 295, right fore- and hind wing; Fig. 296, head in frontal view; Fig. 297, head and thorax in dorsal view. [Illustrations by Diane T. Sands (295) and Victoria Saxe (296, 297)]



FIGURES 298–303. *Chrysopodes* (*Chrysopodes*) *varicosa* (Navás). Fig. 298, right fore- and hind wings; Fig. 299, head in frontal view; Fig. 300, head and thorax in dorsal view; Fig. 301, male abdomen in lateral view; Fig. 302, male genitalia in dorsal view; Fig. 303, male genitalia in lateral view. [Illustrations by Virginia Kirsch (298–300) and Norman Penny (301–303)]



FIGURES 304–309. *Chrysopodes* (*Chrysopodes*) *victoriae* Penny. Fig. 304, right fore- and hind wings; Fig. 305, head in frontal view; Fig. 306, head and thorax in dorsal view; Fig. 307, male abdomen in lateral view; Fig. 308, male genitalia in dorsal view; Fig. 309, male genitalia in lateral view. (Reprinted from Penny, 1998).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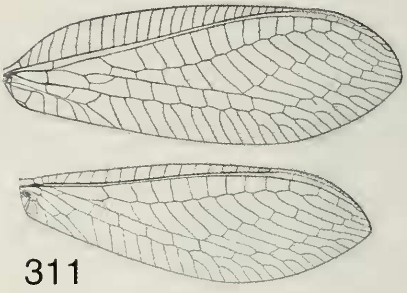
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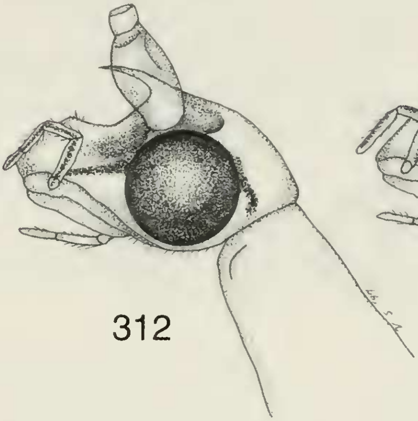
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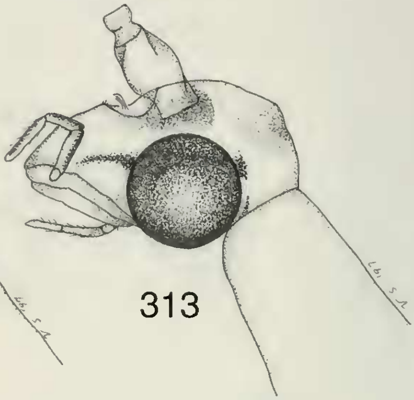
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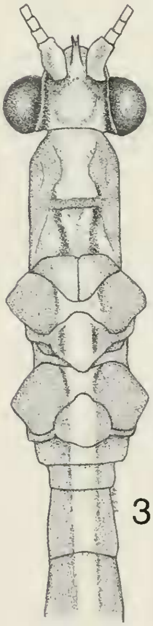
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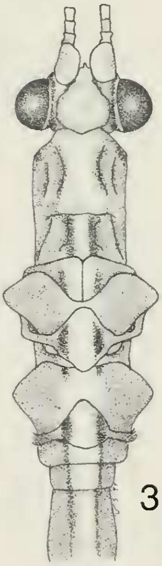
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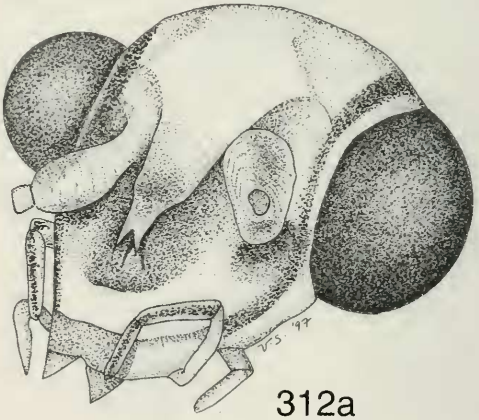
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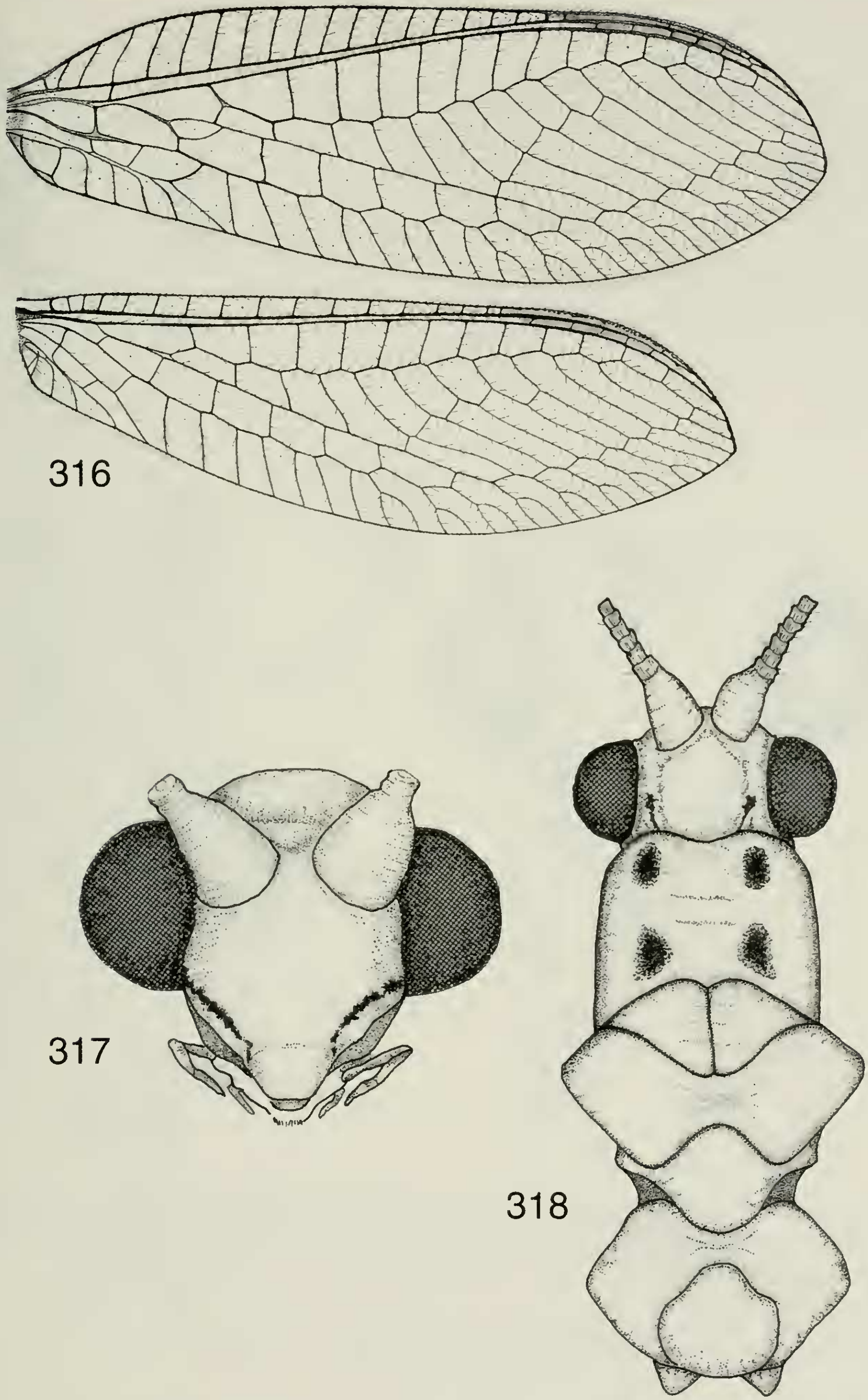
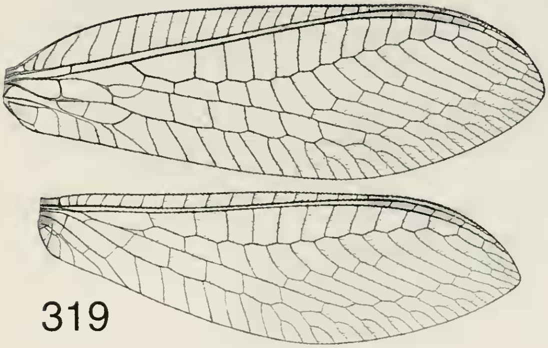
FIGURES 310–315. *Meleoma spp. Meleoma poolei* Adams. Fig. 310, right fore- and hind wings; Fig. 313, head in lateral view; Fig. 315, head and thorax in dorsal view. *Meleoma titschacki* Navás. Fig. 311, right fore- and hind wings; Fig. 312, head lateral view; Fig. 312a, head in dorsolateral view; Fig. 314, head and thorax in dorsal view. [Illustrations by Dahlia Helguera (310 forewing), Virginia Kirsch (310 hind wing, 311), and Victoria Saxe (312–315)]



Figures 316–318. *Plesiochrysa brasiliensis* (Schneider). Fig. 316, right fore- and hind wings; Fig. 317, head in frontal view; Fig. 318, head and thorax in lateral view. [Illustrations by Virginia Kirsch (316) and Barnaby Hall (317, 318)]



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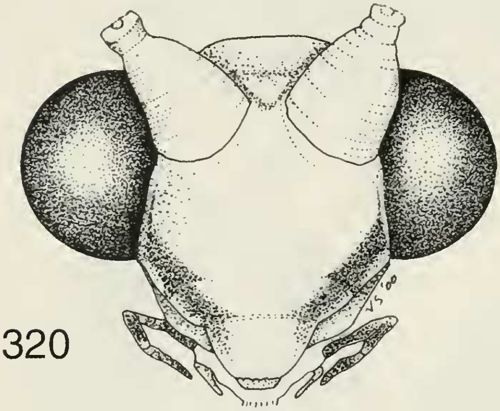

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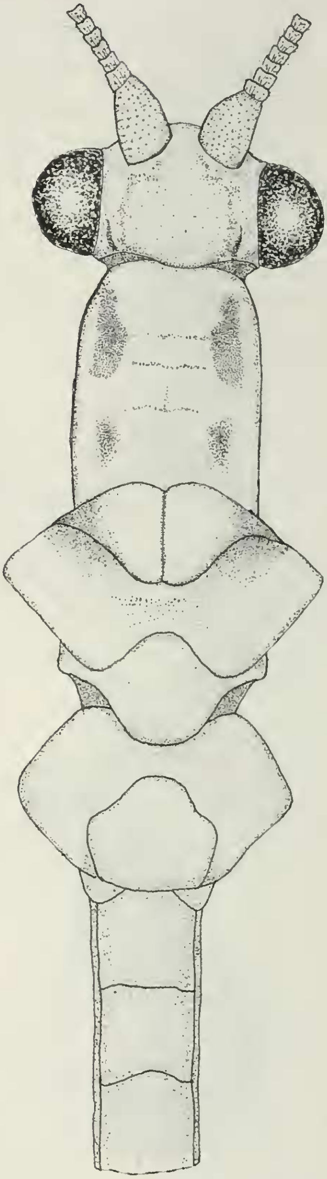

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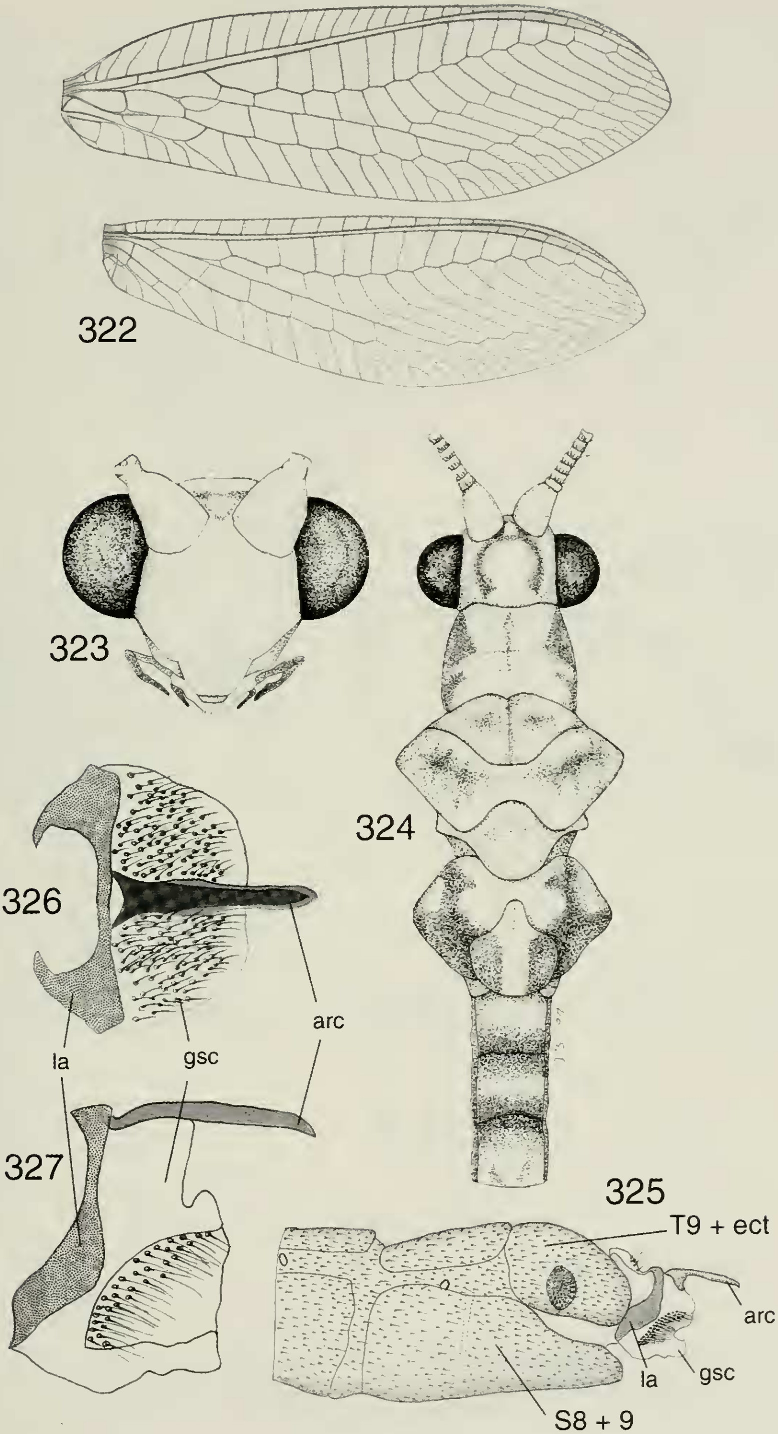
FIGURES 319–321. *Plesiochrysa elongata* (Navás). Fig. 319, right fore- and hind wings; Fig. 320, head in frontal view; Fig. 321, head and thorax in dorsal view. [Illustrations by Virginia Kirsch (319), Victoria Saxe (320), and Barnaby Hall (321)]



FIGURES 322–327. *Ungla pallescens* Penny. Fig. 322, right fore- and hind wings; Fig. 323, head in frontal view; Fig. 324, head and thorax in dorsal view; Fig. 325, male abdomen in lateral view; Fig. 326, male genitalia in dorsal view; Fig. 327, male genitalia in lateral view. (Reprinted from Penny, 1998)

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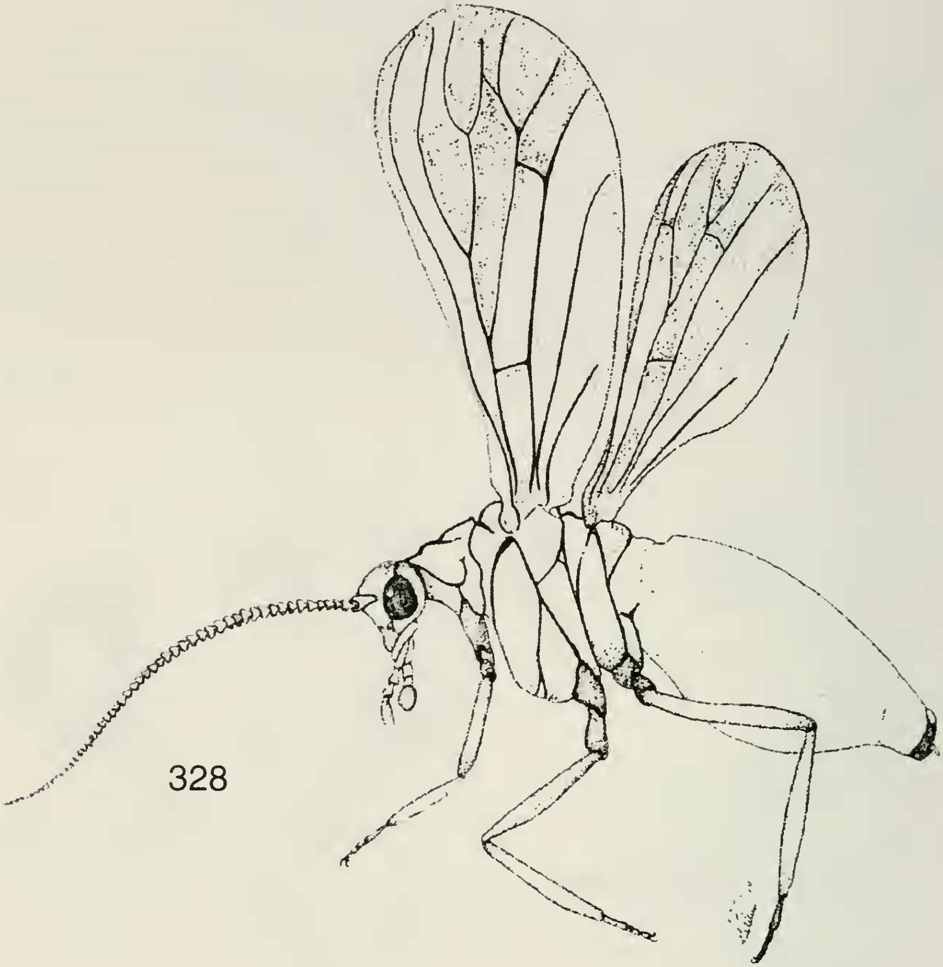
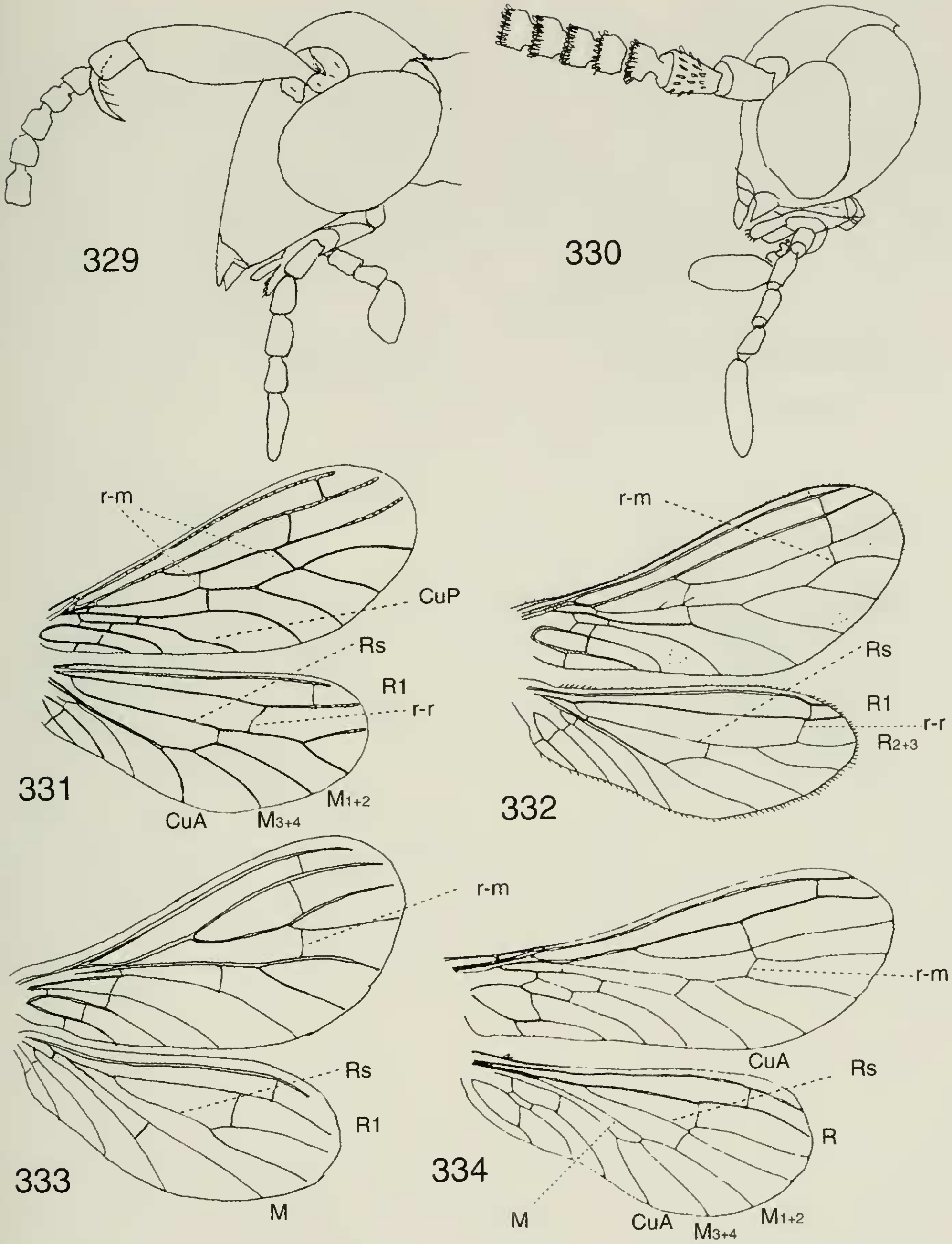
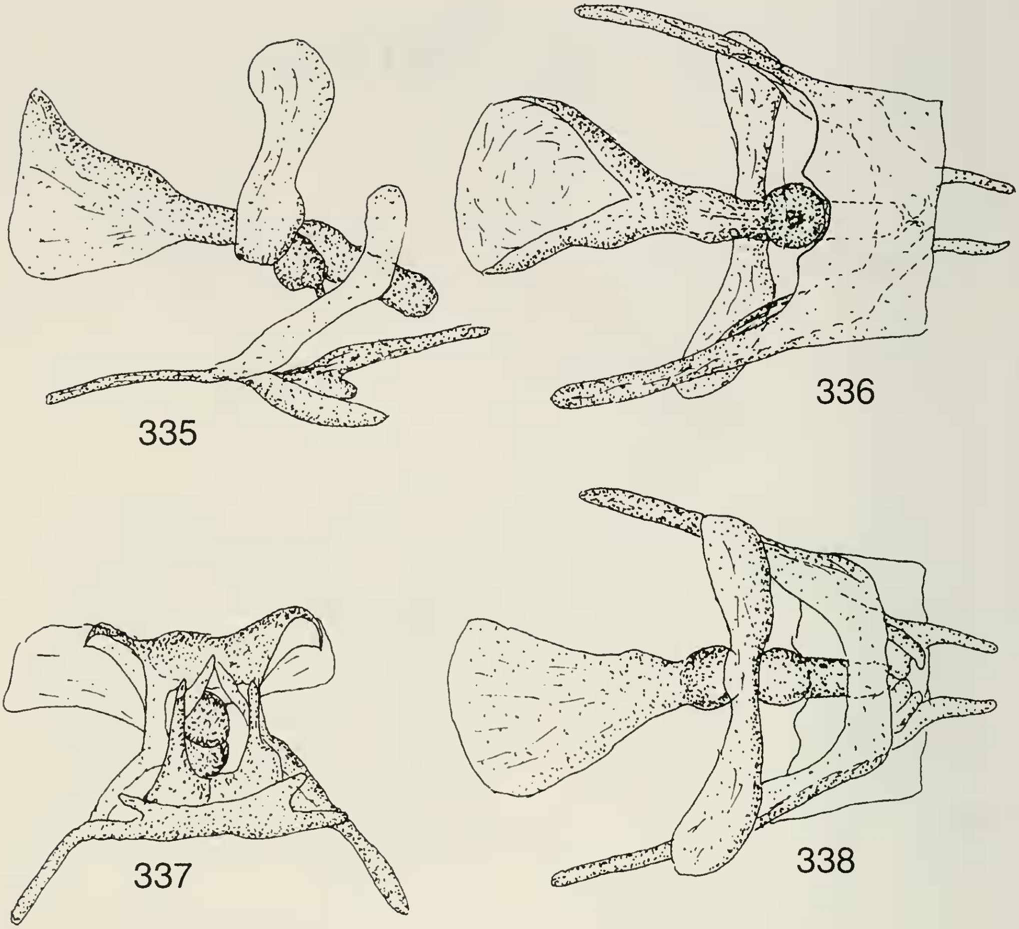


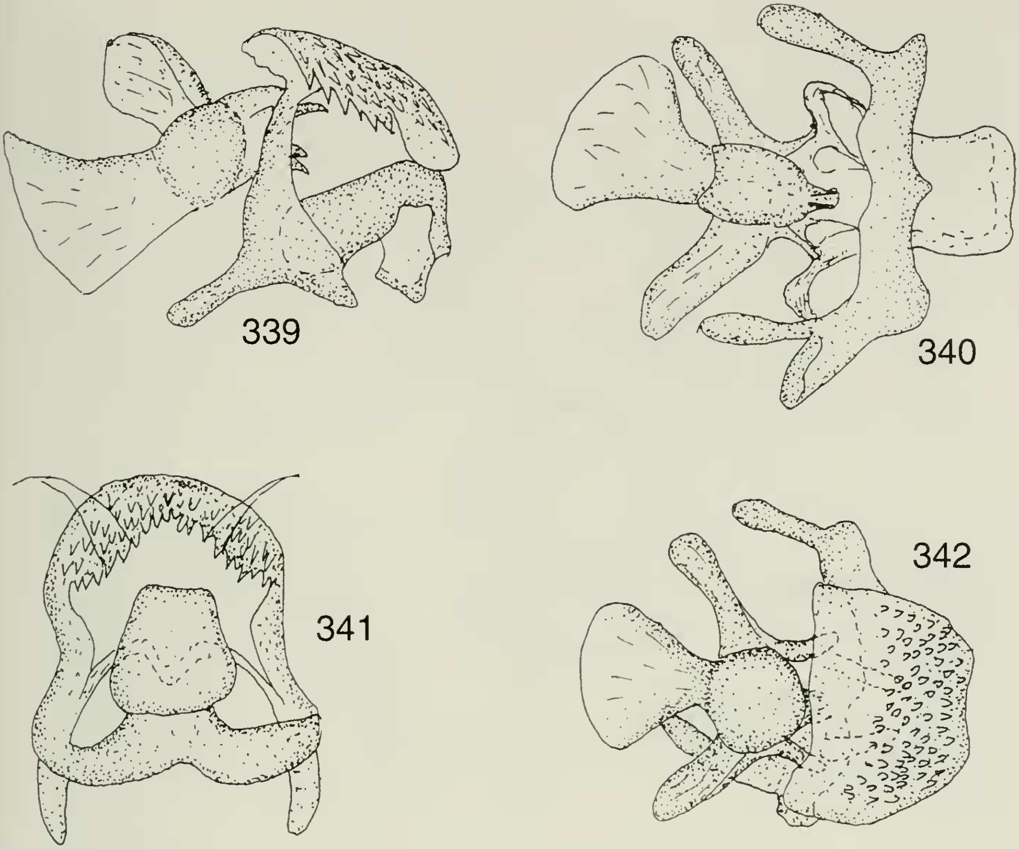
FIGURE 328. *Coniopteryx* sp. habitus view. (Illustration by Artêmio Coelho da Silva)



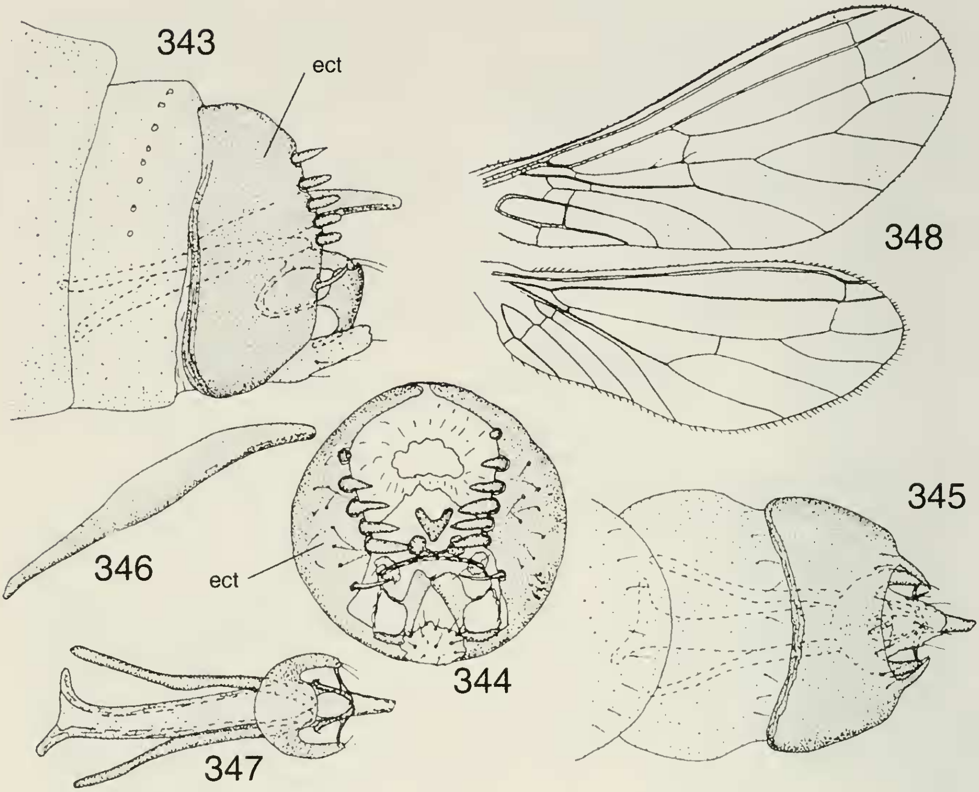
FIGURES 329–334. Fig. 329, *Aleuropteryx clavicornis*, head in lateral view; Fig. 330, *Coniopteryx* sp., head in lateral view; Fig. 331. *Aleuropteryx* sp., right fore- and hind wings; Fig. 332. *Neoconis* sp., right fore- and hind wings; Fig. 333, *Coniopteryx* sp., right fore- and hind wings; Fig. 334, *Semidalis* sp., right fore- and hind wings. (Illustrations by Martin Meinander)



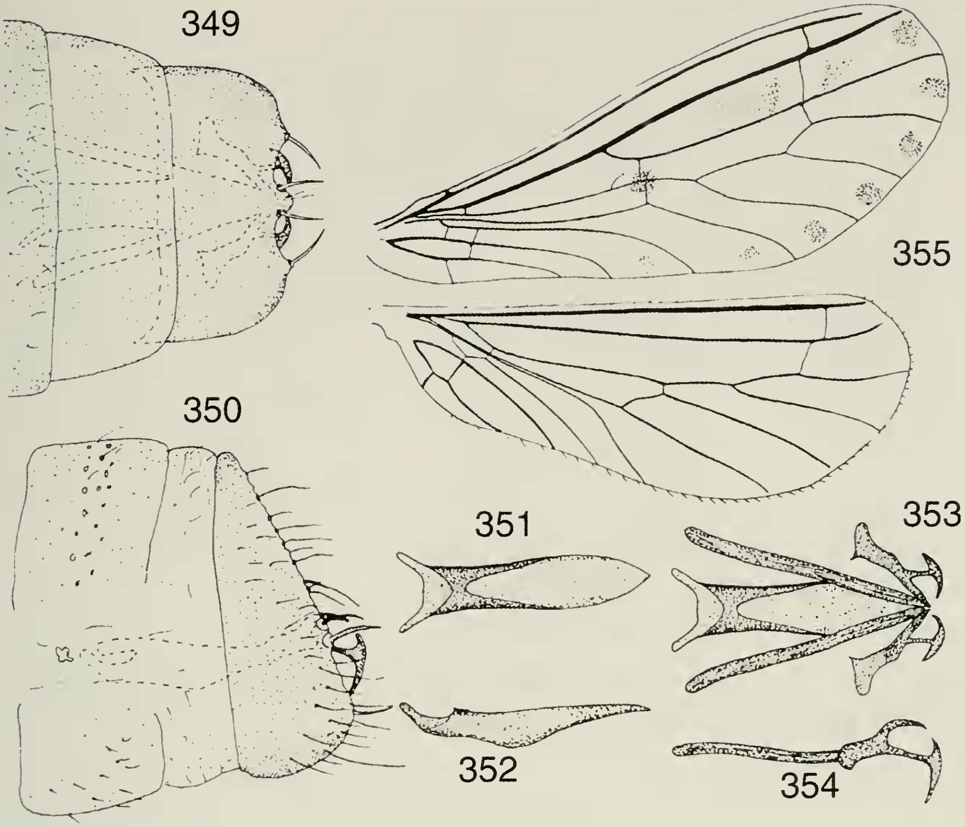
FIGURES 335–338. *Aleuropteryx clavicornis* Meinander. Fig. 335, internal male genitalia lateral view; Fig. 336, internal male genitalia ventral view; Fig. 337, internal male genitalia caudal view; Fig. 338, internal male genitalia dorsal view. (Illusrations by Martin Meinander)



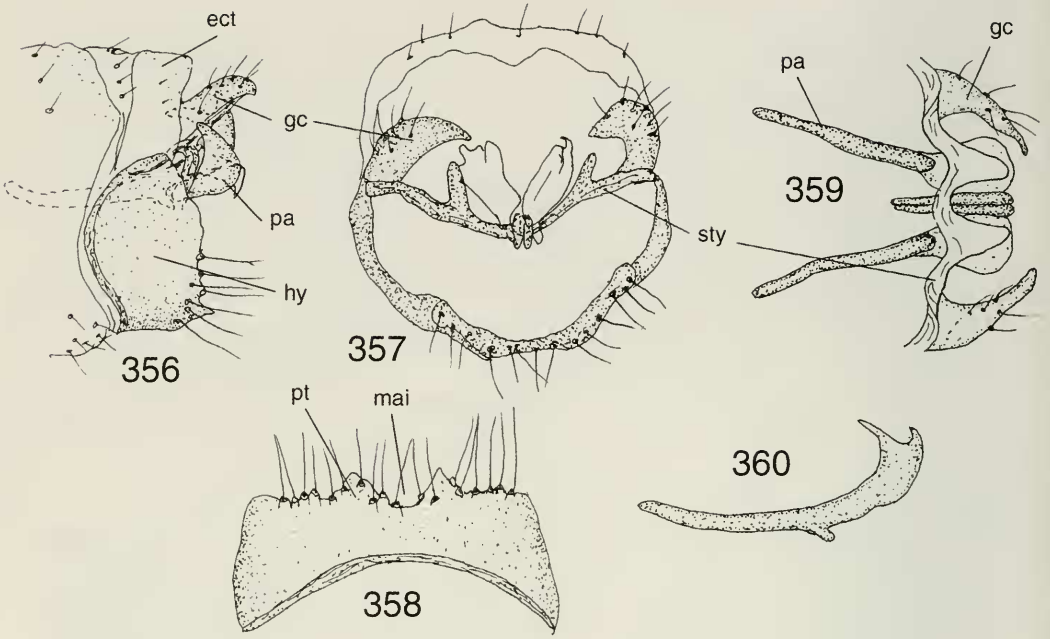
FIGURES 339–342. *Aleuropteryx rugosa* Meinander. Fig. 339, internal male genitalia in lateral view; Fig. 340, internal male genitalia in ventral view; Fig. 341, internal male genitalia in caudal view; Fig. 342, internal male genitalia in dorsal view. (Illustrations by Martin Meinander)



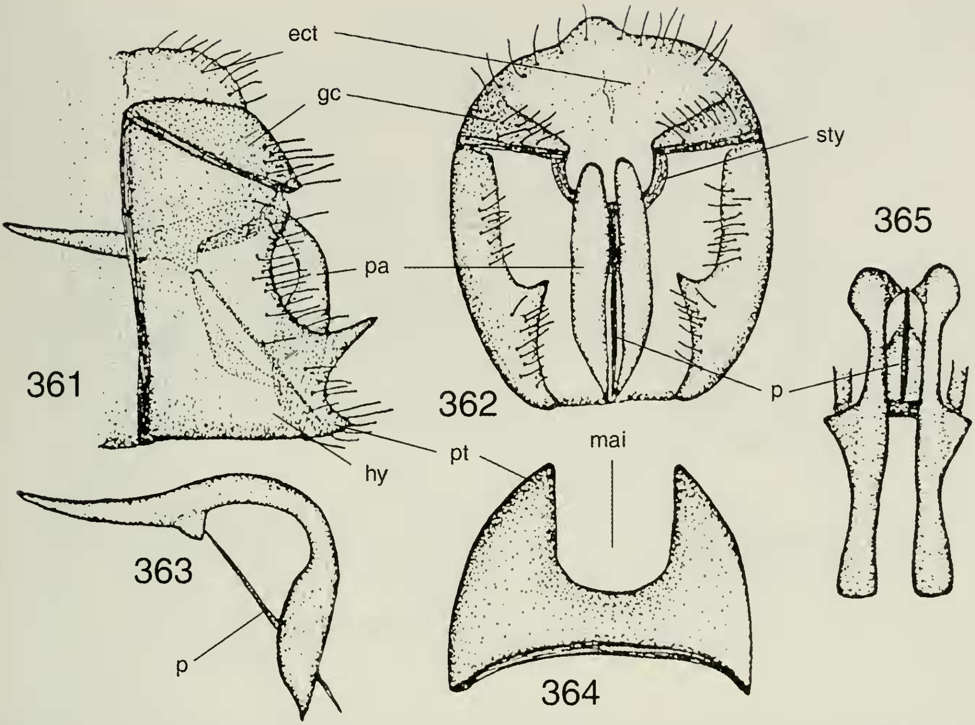
FIGURES 343–348. *Neoconis dentata* Meinander. Fig. 343, male genitalia in lateral view; Fig. 344, male genitalia in caudal view ; Fig. 345, male genitalia in ventral view; Fig. 346, male paramere in lateral view; Fig. 347, internal male genitalia in ventral view; Fig. 348, right fore- and hind wings. (Illustrations by Martin Meinander)



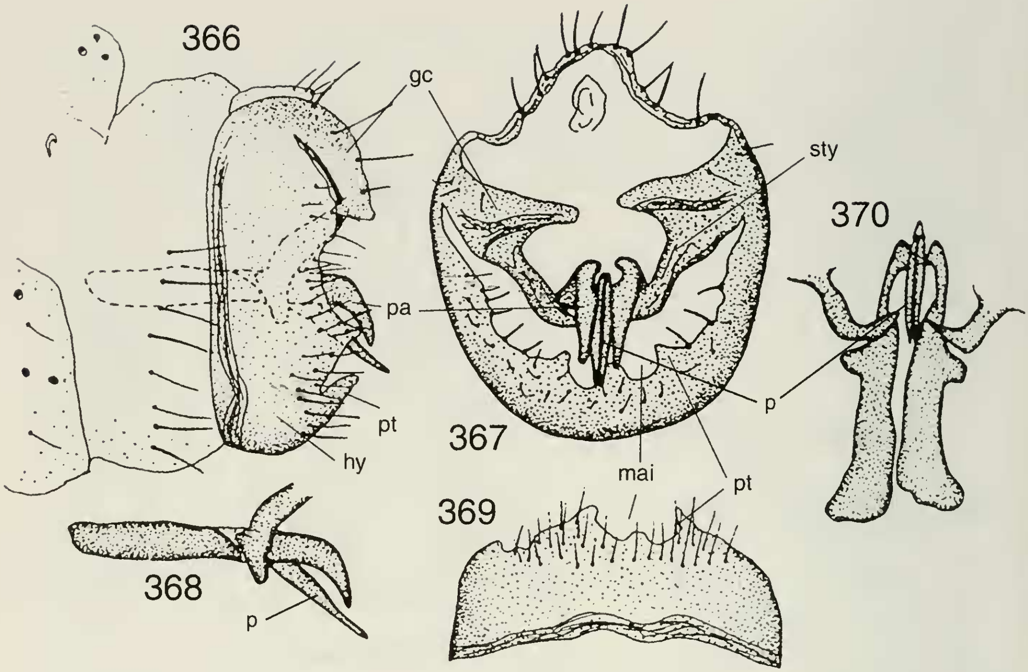
FIGURES 349–355. *Neoconis marginata* Meinander. Fig. 349, male genitalia in ventral view; Fig. 350, male genitalia in lateral view; Fig. 351, penis in dorsal view; Fig. 352, penis in lateral view; Fig. 353, internal male genitalia in dorsal view; Fig. 354, paramere and stylus in lateral view; Fig. 355, right fore- and hind wings. (Illustrations by Martin Meinander)



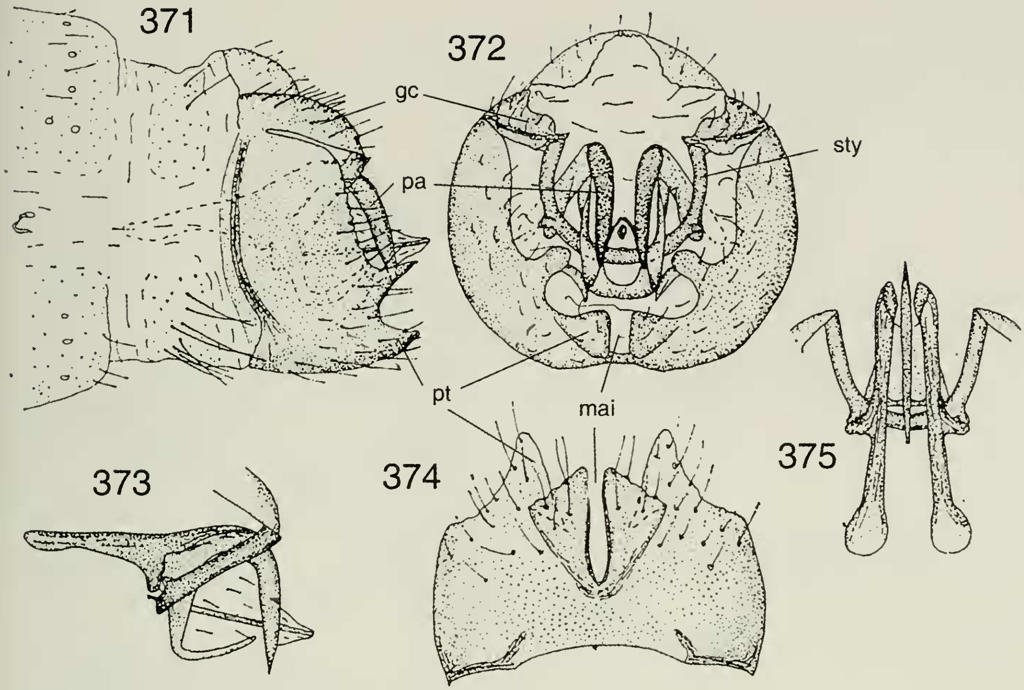
FIGURES 356–360. *Coniopteryx* (*Xeroconiopteryx*) *falcata* Meinander. Fig. 356, male genitalia in lateral view; Fig. 357, male genitalia in caudal view; Fig. 358, hypandrium in ventral view; Fig. 359, gonarcus, styli and interal genitalia in ventral view; Fig. 360, paramere in lateral view. (Illustrations by Martin Meinander)



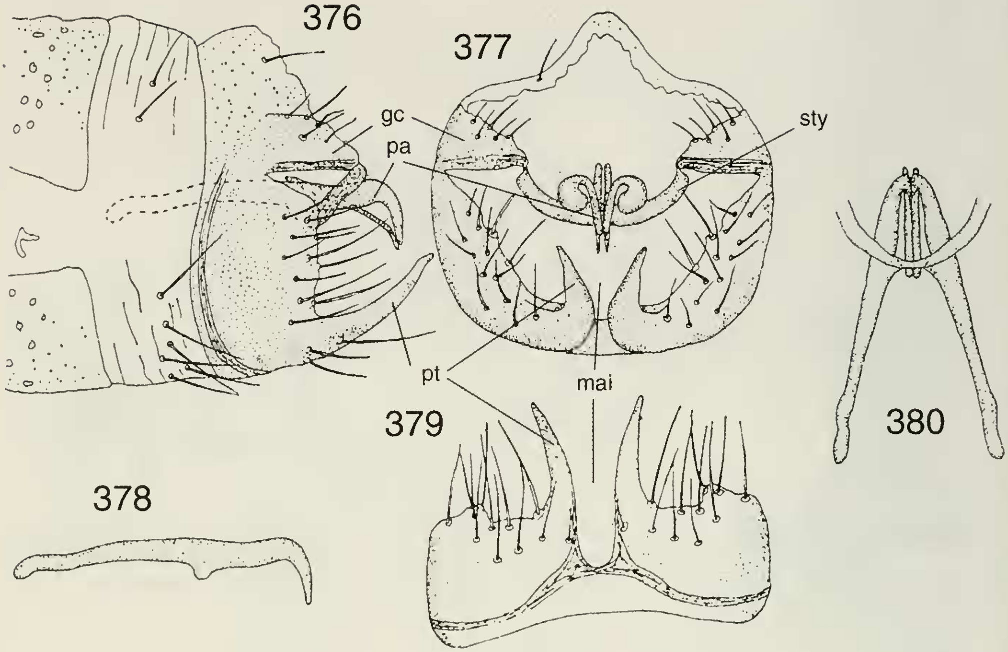
FIGURES 361–365. *Coniopteryx* (*Scotoconiopteryx*) *cyphodera* Johnson. Fig. 361, male genitalia in lateral view; Fig. 362, male genitalia in caudal view; Fig. 363, internal male genitalia in lateral view; Fig. 364, hypandrium in ventral view; Fig. 365, internal male genitalia in ventral view. (Illustrations by Martin Meinander)



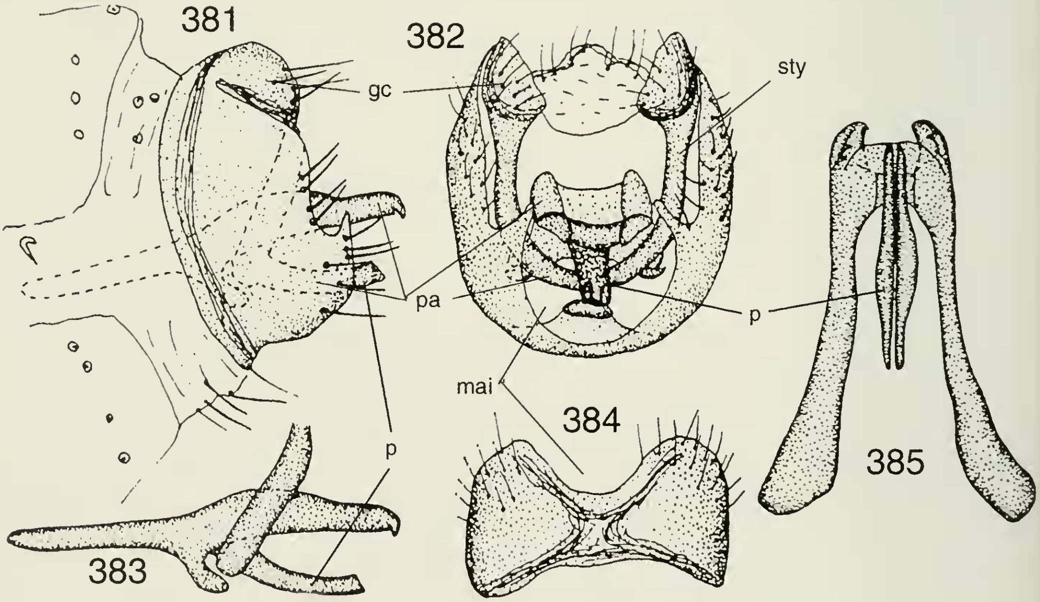
FIGURES 366–370. *Coniopteryx* (*Scotoconiopteryx*) *flinti* Meinander. Fig. 366, male genitalia in lateral view; Fig. 367, male genitalia in caudal view; Fig. 368, internal male genitalia in lateral view; Fig. 369, hypandrium in ventral view; Fig. 370, internal male genitalia in ventral view. (Illustrations by Martin Meinander)



FIGURES 371–375. *Coniopteryx* (*Scotoconiopteryx*) *fumata* Enderlein. Fig. 371, male genitalia in lateral view; Fig. 372, male genitalia in caudal view; Fig. 373, internal male genitalia in lateral view; Fig. 374, hypandrium in ventral view; Fig. 375, internal male genitalia in ventral view. (Illustrations by Martin Meinander)



FIGURES 376–380. *Coniopteryx* (*Scotoconiopteryx*) *isthmicola* Meinander. Fig. 376, male genitalia in lateral view; Fig. 377, male genitalia in caudal view; Fig. 378, paramere in lateral view; Fig. 379, hypandrium in ventral view; Fig. 380, parameres, styli and penis sclerites in ventral view. (Illustrations by Martin Meinander)



FIGURES 381–385. *Coniopteryx* (*Scotoconiopteryx*) *panamensis* Meinander. Fig. 381, male terminalia in lateral view; Fig. 382, male terminalia in caudal view; Fig. 383, internal male genitalia in lateral view; Fig. 384, hypandrium in ventral view; Fig. 385, internal male genitalia in ventral view . (Illustrations by Martin Meinander)

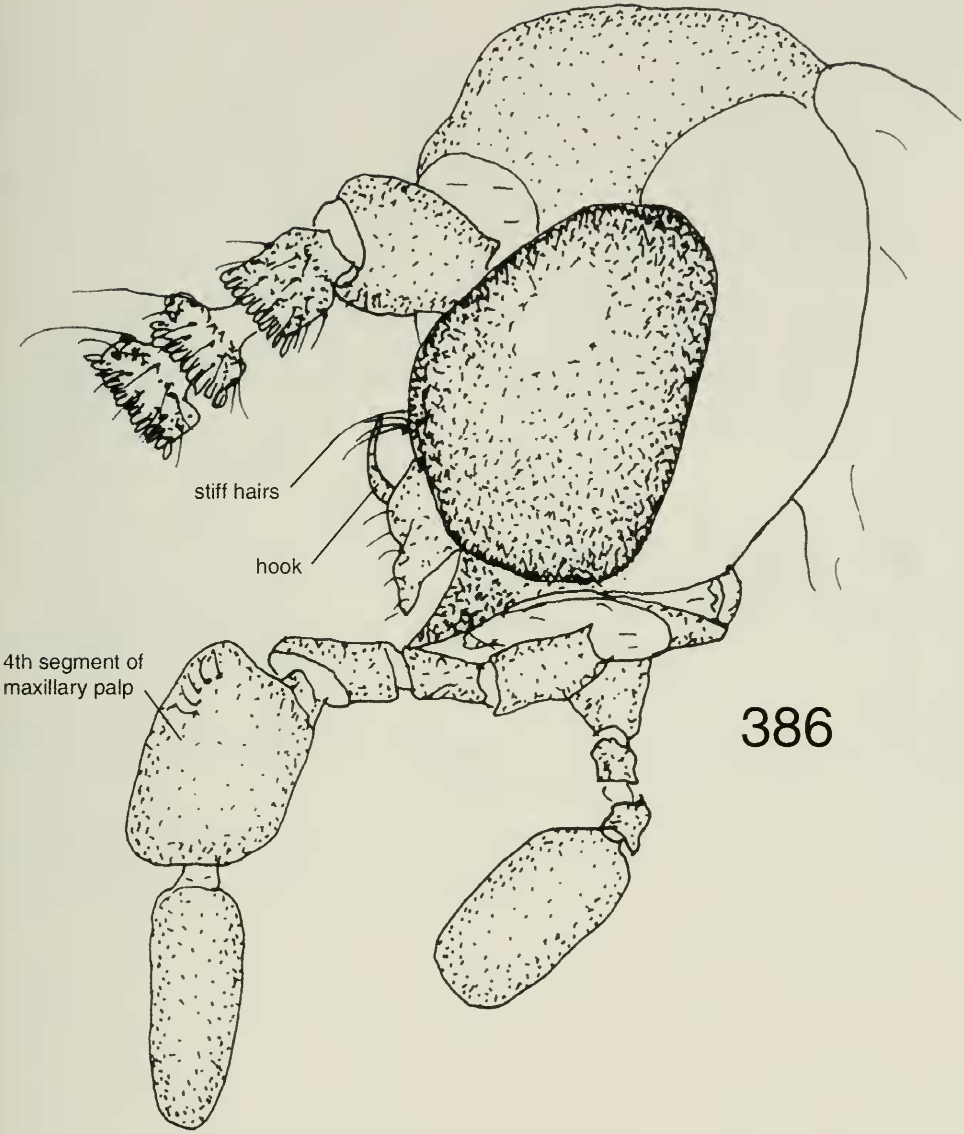
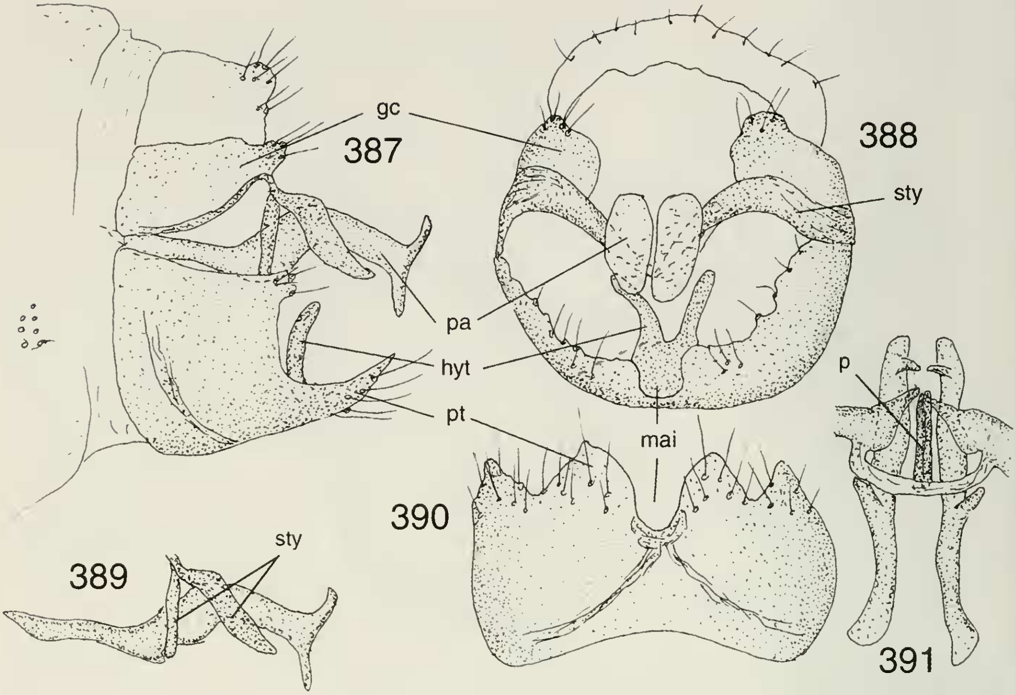
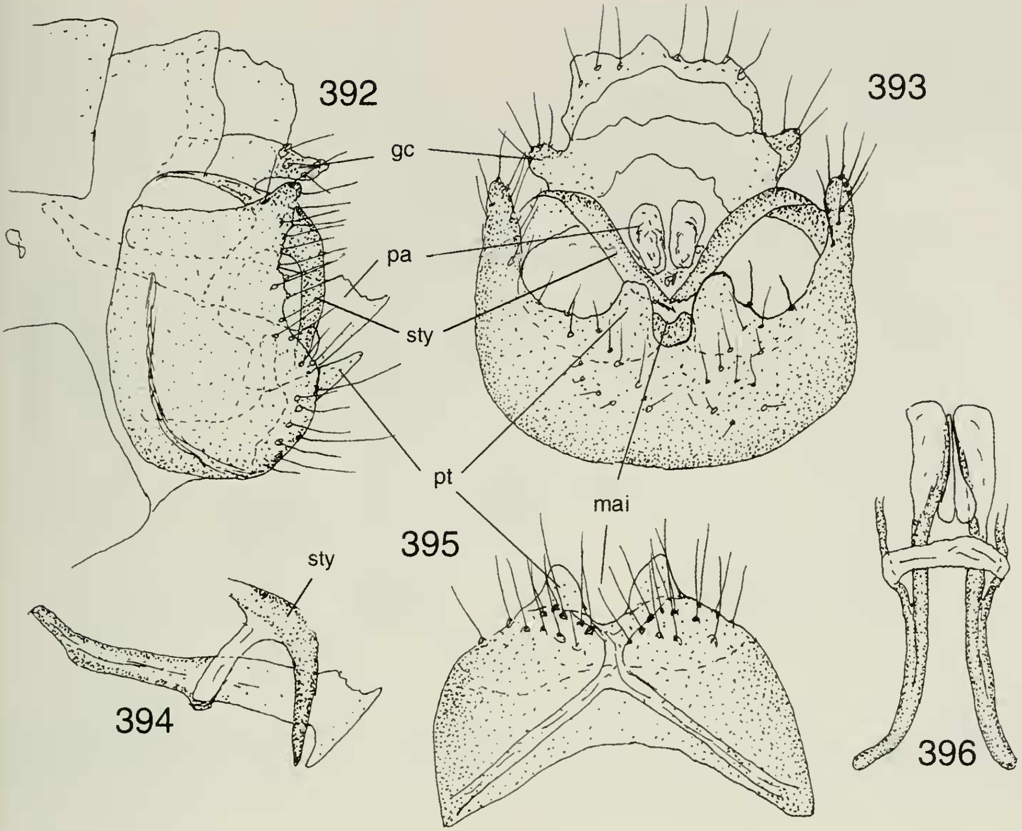


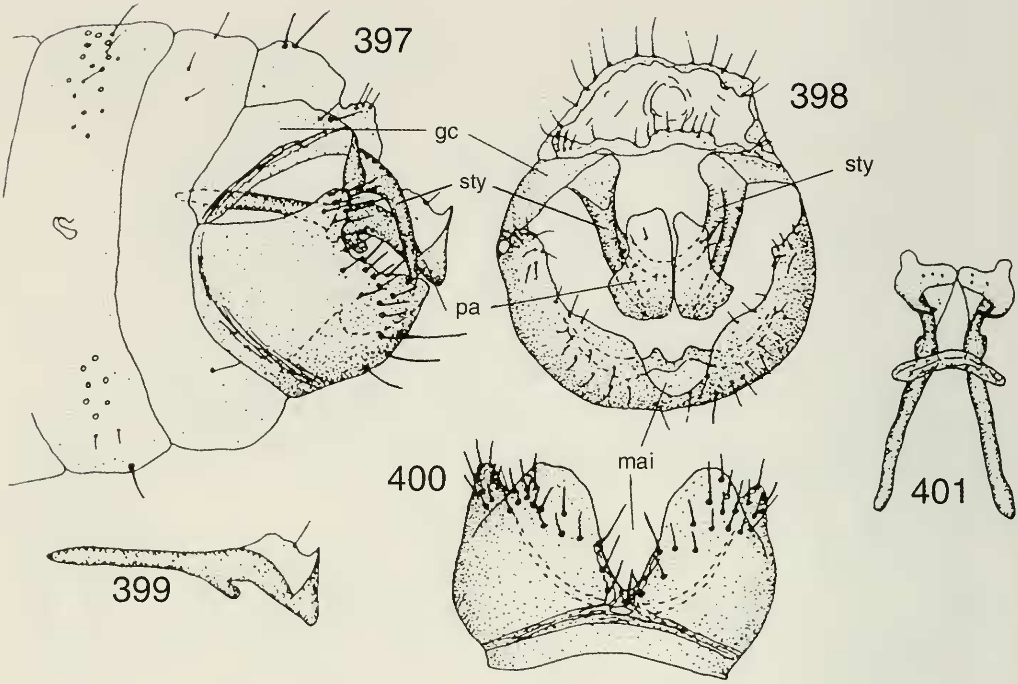
FIGURE 386. *Coniopteryx* (*Coniopteryx*) *californica* Meinander. head in lateral view.



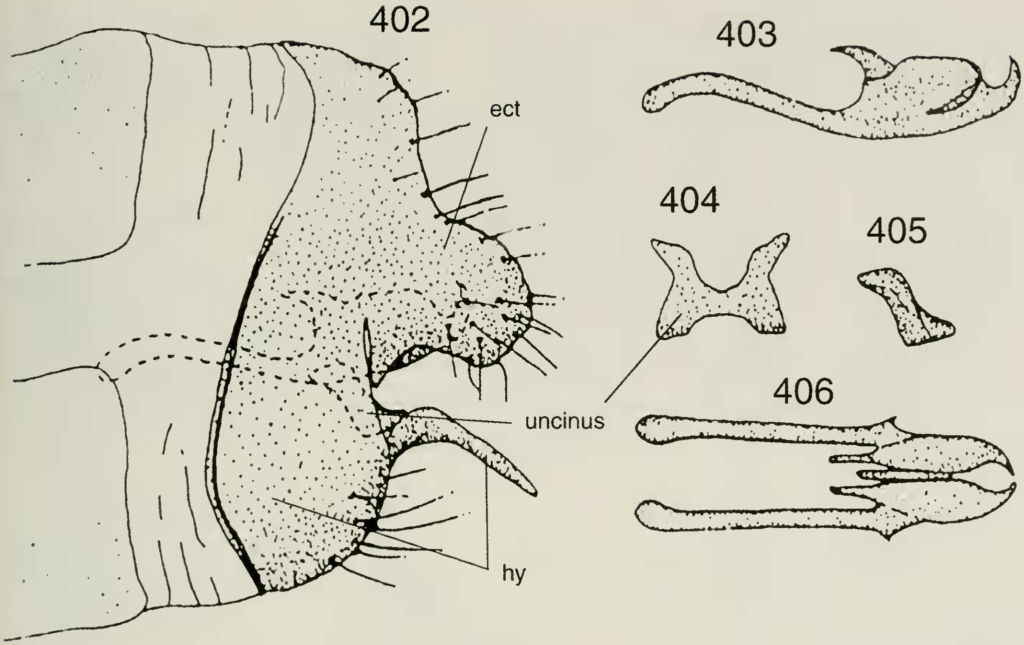
FIGURES 387–391. *Coniopteryx* (*Coniopteryx*) *californica* Meinander. Fig. 387, male genitalia in lateral view; Fig. 388, male genitalia in caudal view; Fig. 389, internal male genitalia in lateral view; Fig. 390, hypandrium in ventral view; Fig. 391, internal male genitalia in ventral view. (Illustrations by Martin Meinander)



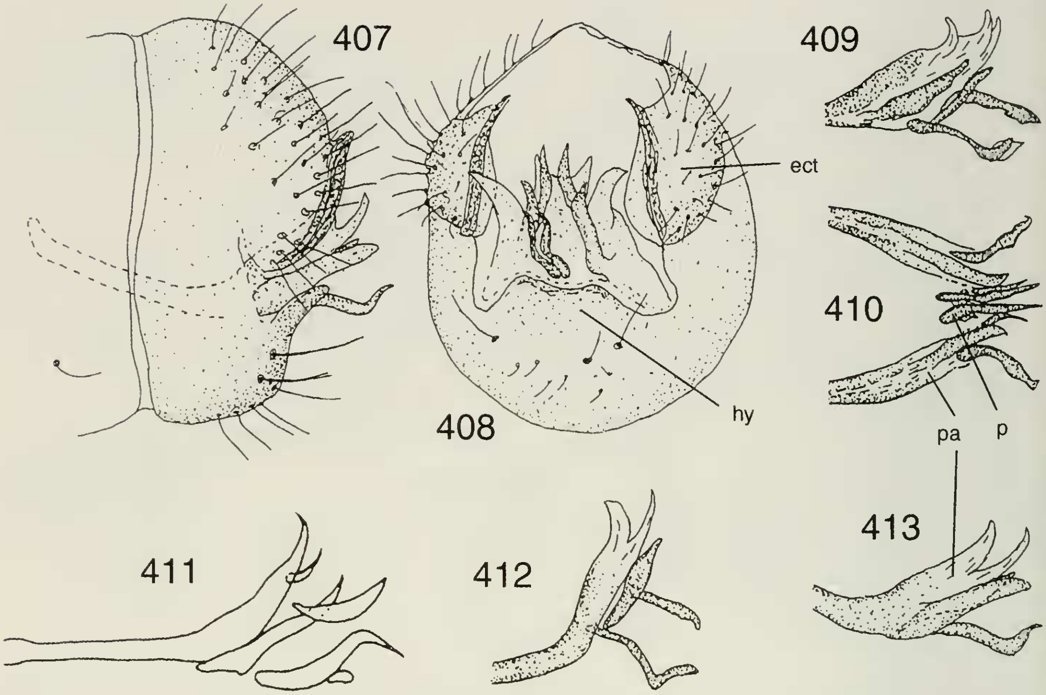
FIGURES 392–396. *Coniopteryx* (*Coniopteryx*) *freytagorum* Johnson. Fig. 392, male genitalia in lateral view; Fig. 393, male genitalia in caudal view; Fig. 394, internal male genitalia in lateral view; Fig. 395, hypandrium in ventral view; Fig. 396, internal male genitalia in ventral view. (Illustrations by Martin Meinander)



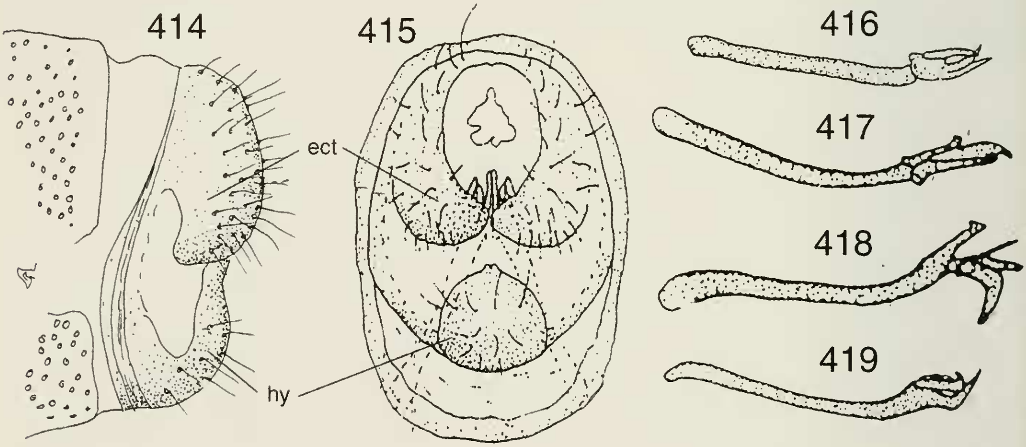
FIGURES 397–401. *Coniopteryx* (*Coniopteryx*) *mexicana* Meinander. Fig. 397, male genitalia in lateral view; Fig. 398, male genitalia in caudal view; Fig. 399, paramere in lateral view; Fig. 400, hypandrium in ventral view; Fig. 401, internal male genitalia in ventral view. (Illustrations by Martin Meinander)



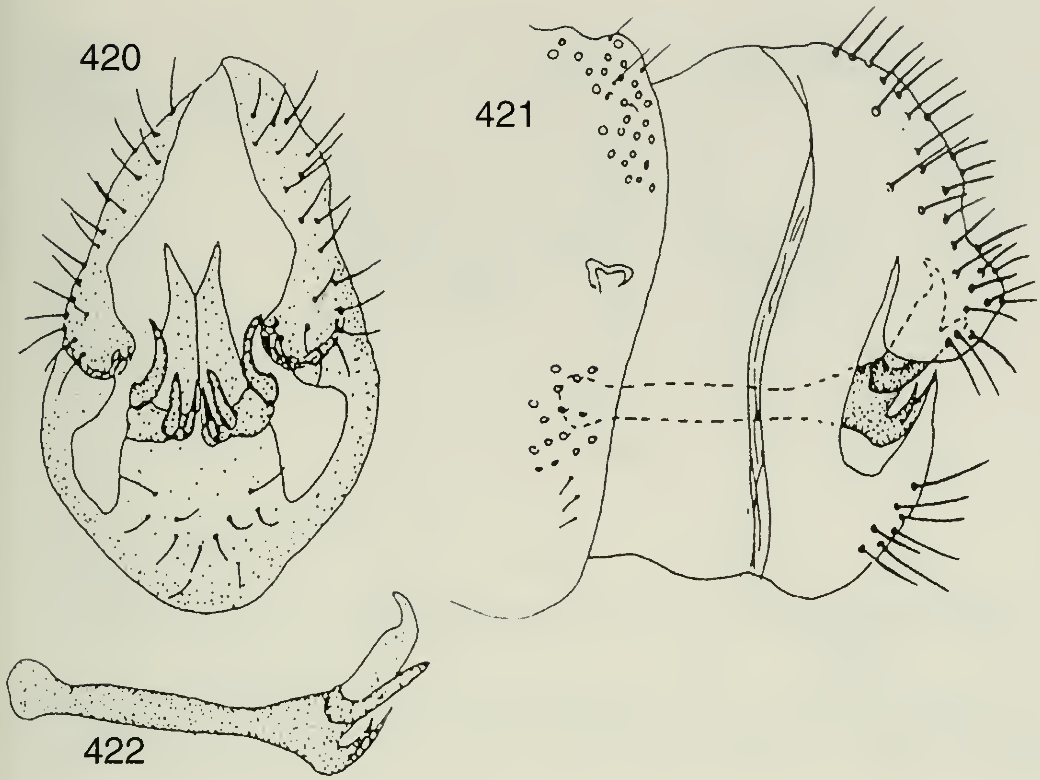
FIGURES 402–406. *Semidalis arnaudi* Meinander. Fig. 402, male genitalia in lateral view; Fig. 403, parameres in lateral view; Fig. 404, uncini in caudal view; Fig. 405, uncini in lateral view; Fig. 406, parameres in ventral view . (Illustrations by Martin Meinander)



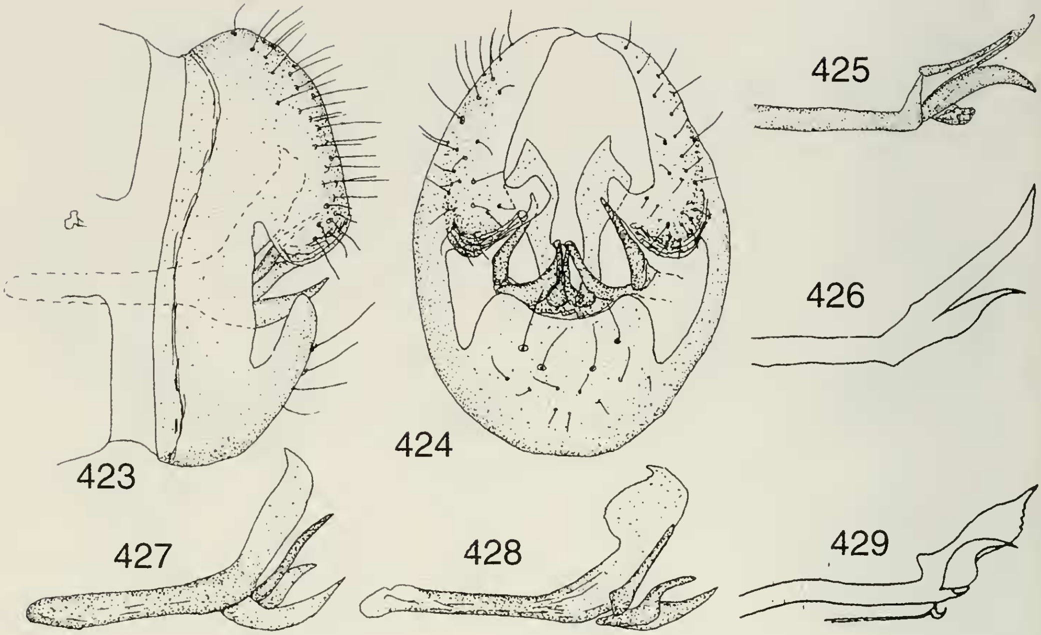
FIGURES 407–413. *Semidalis manausensis* Meinander. Fig. 407, male genitalia in lateral view; Fig. 408, male genitalia in caudal view; Fig. 409, internal male genitalia in lateral view; Fig. 410, internal male genitalia in ventral view; Fig. 411, internal male genitalia in lateral view; Fig. 412, internal male genitalia in lateral view; Fig. 413, internal male genitalia in lateral view. (Illustrations by Martin Meinander)



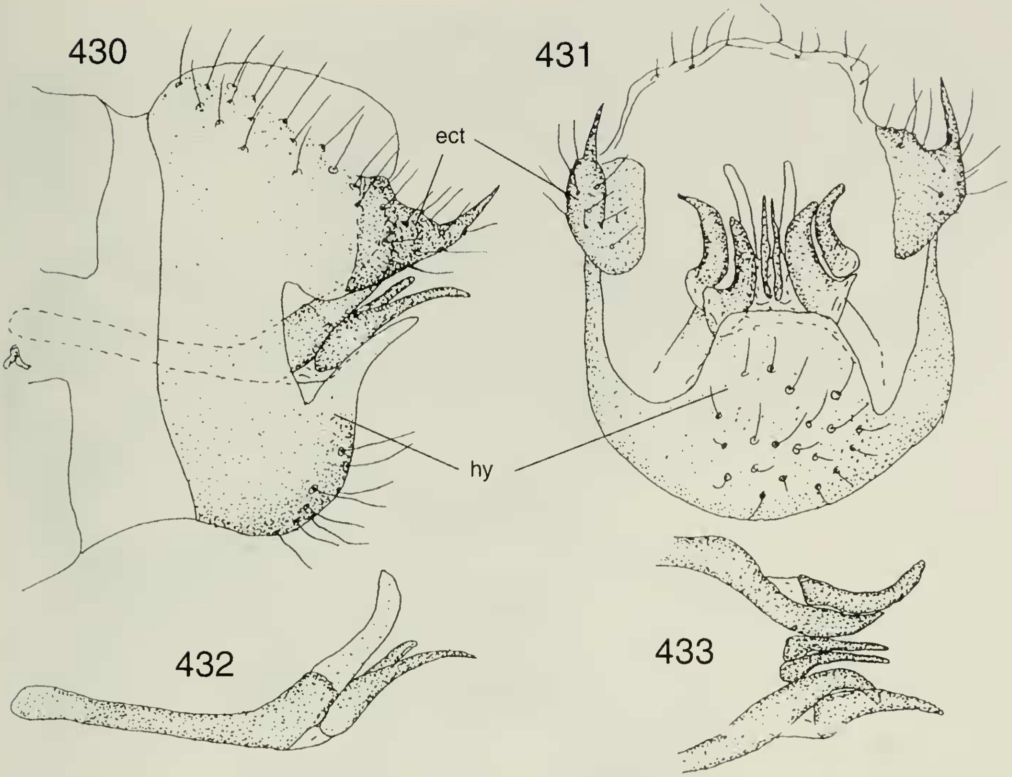
FIGURES 414–419. *Semidalis mexicana* Meinander. Fig. 414, male genitalia in lateral view; Fig. 415, male genitalia in caudal view; Fig. 416, internal male genitalia in lateral view; Fig. 417, internal male genitalia in lateral view; Fig. 418, internal male genitalia in lateral view; Fig. 419, internal male genitalia in lateral view. (Illustrations by Martin Meinander)



FIGURES 420–422. *Semidalis panamensis* Meinander. Fig. 420, male genitalia in caudal view; Fig. 421, male genitalia in lateral view; Fig. 422, internal male genitalia in lateral view. (Illustrations by Martin Meinander)



FIGURES 423–429. *Semidalis rondoniensis* Meinander. Fig. 423, male genitalia in lateral view; Fig. 424, male genitalia in caudal view; Fig. 425, internal male genitalia in lateral view; Fig. 426, internal male genitalia in lateral view; Fig. 427, internal male genitalia in lateral view; Fig. 428, internal male genitalia in lateral view; Fig. 429, internal male genitalia in lateral view. (Illustrations by Martin Meinander)



FIGURES 430–433. *Semidalis soleri* Monserrat. Fig. 430, male genitalia in lateral view; Fig. 431, male genitalia in caudal view; Fig. 432, internal male genitalia in lateral view; Fig. 433, internal male genitalia in ventral view. (Illustrations by Martin Meinander)

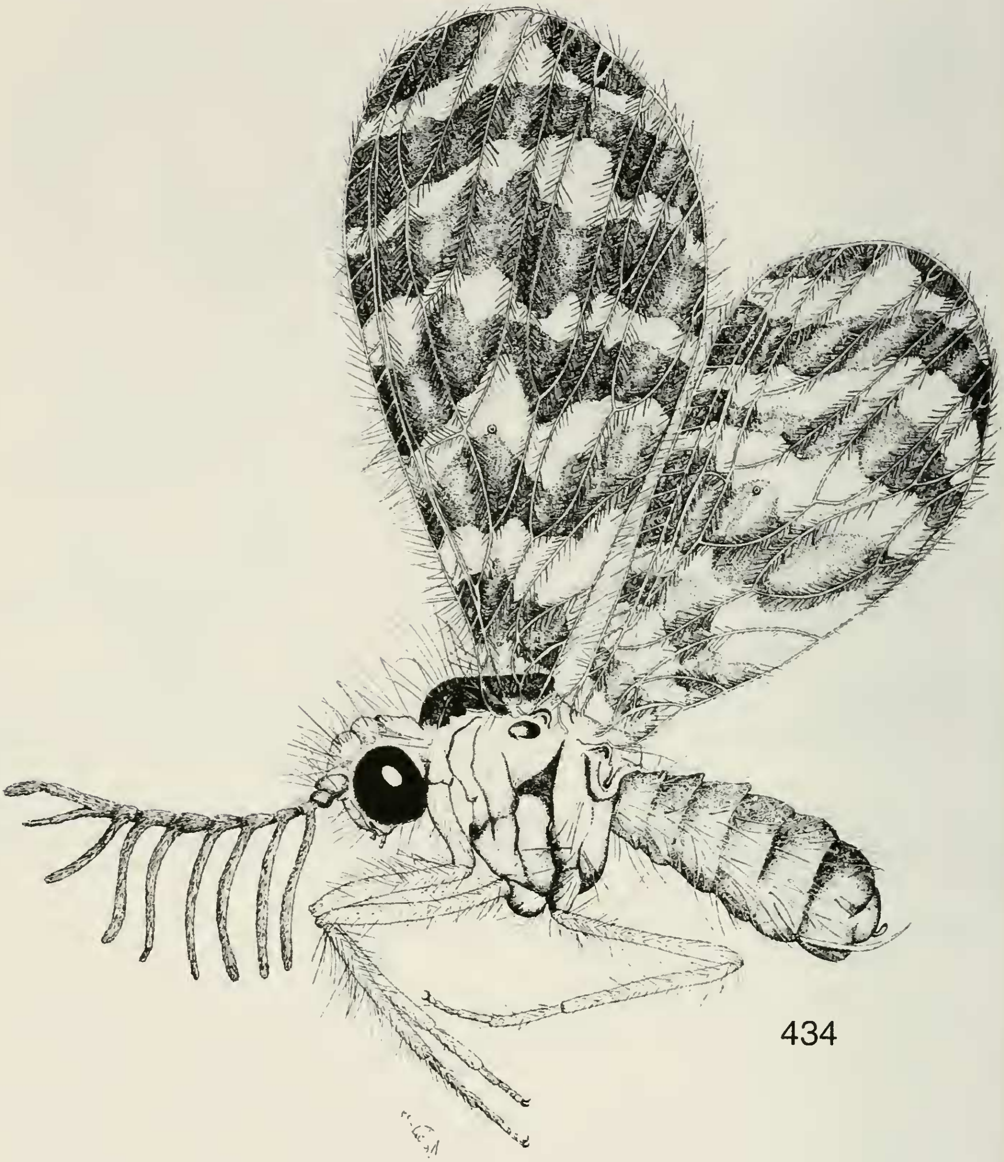


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FIGURE 434. *Nallachius* sp. habitus view. (Illustration by Artêmio Coelho da Silva)

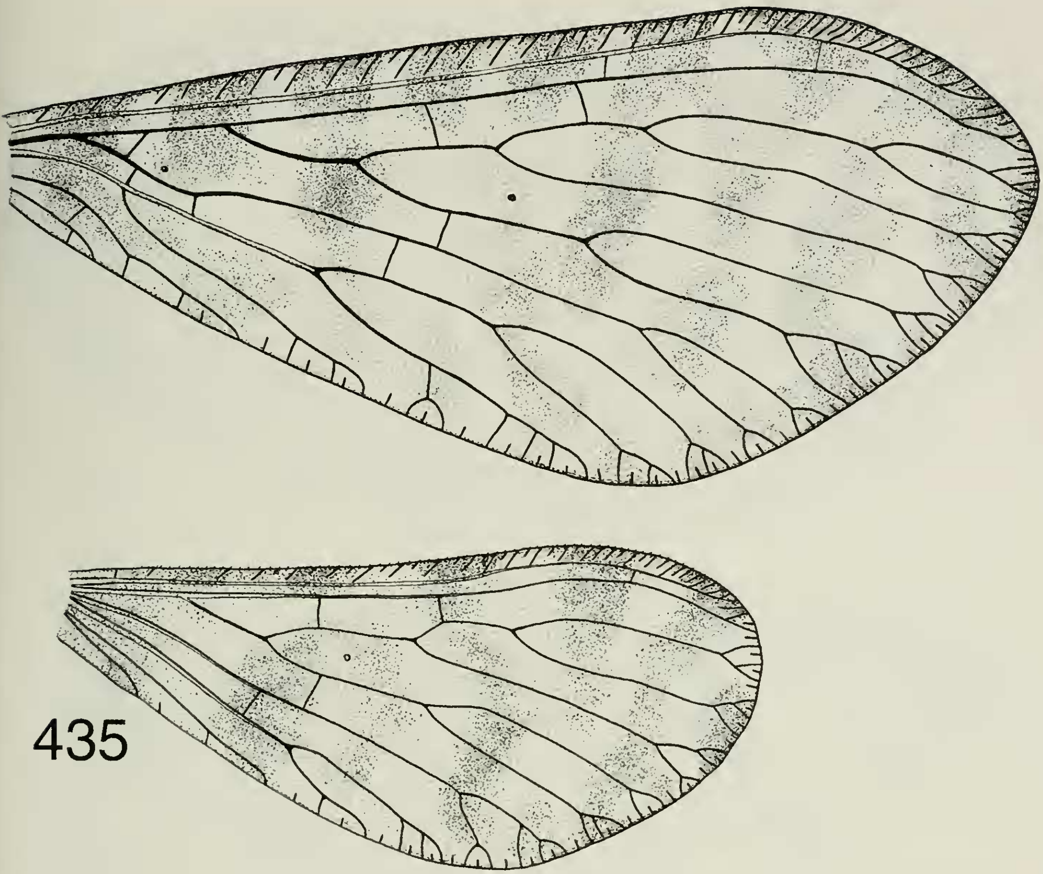

FIGURE 435. *Nallachius americanus* (McLachlan), right fore- and hind wings. (Illustration by Norman D. Penny)

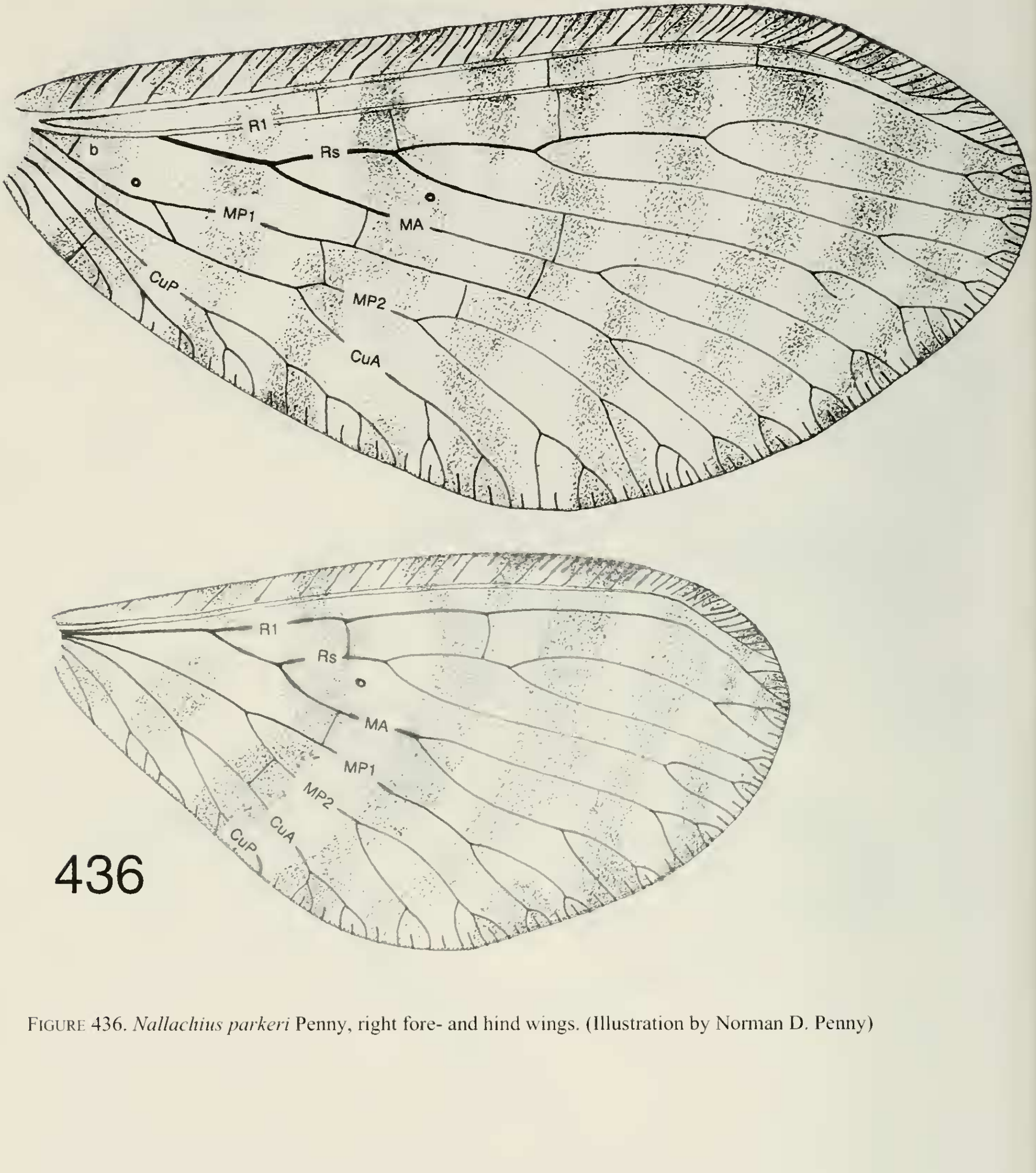

FIGURE 436. *Nallachius parkeri* Penny, right fore- and hind wings. (Illustration by Norman D. Penny)

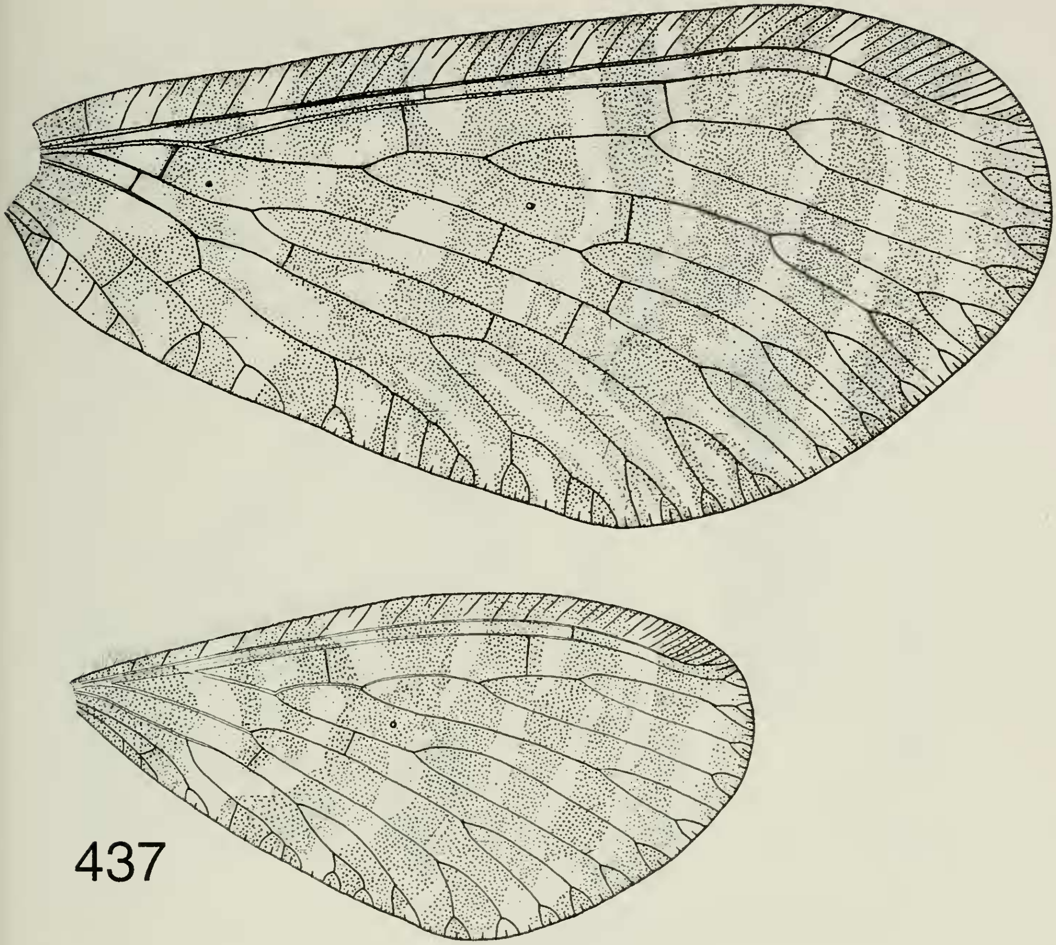

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FIGURE 437. *Nallachius pulchellus* (Banks), right fore- and hind wings. (Illustration by Norman D. Penny)

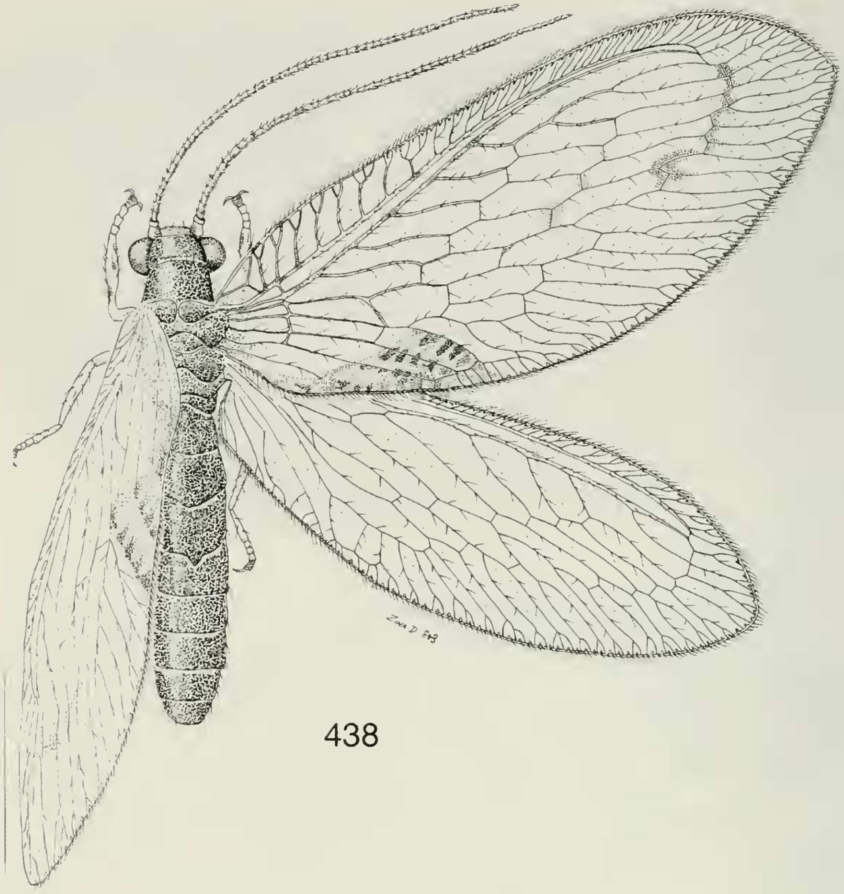

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Figure 438. *Nusalala championi*, habitus drawing in dorsal view. (Illustration by Zina Deretsky)

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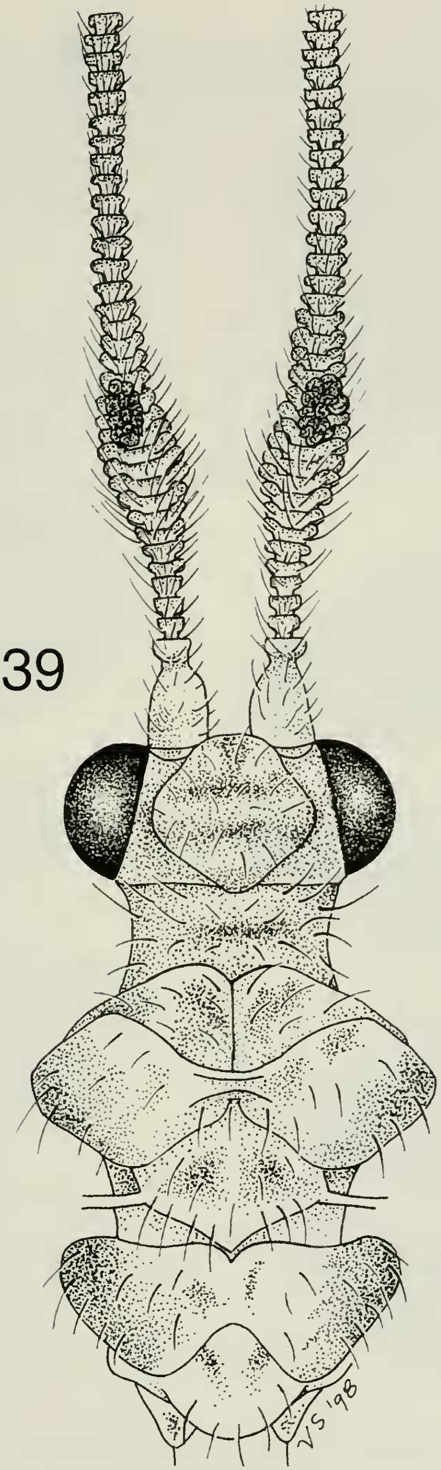
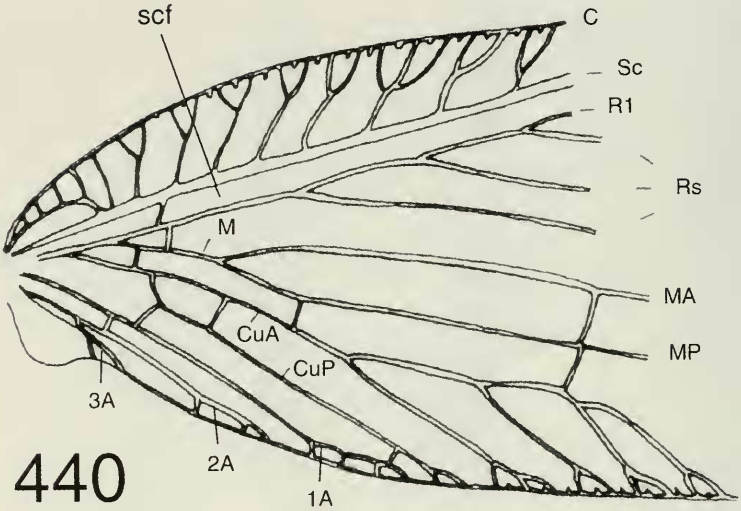


FIGURES 439. *Hemerobius hirsuticornis* Monserrat, head and thorax in dorsal view. (Illustration by Victoria Saxe)



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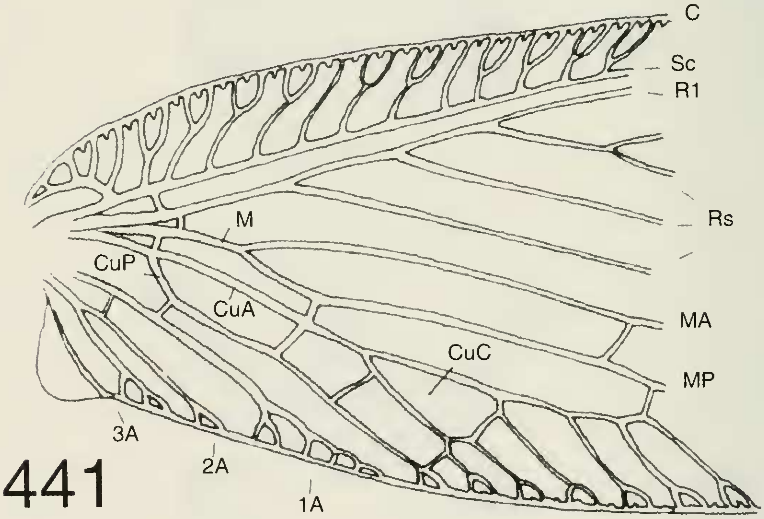

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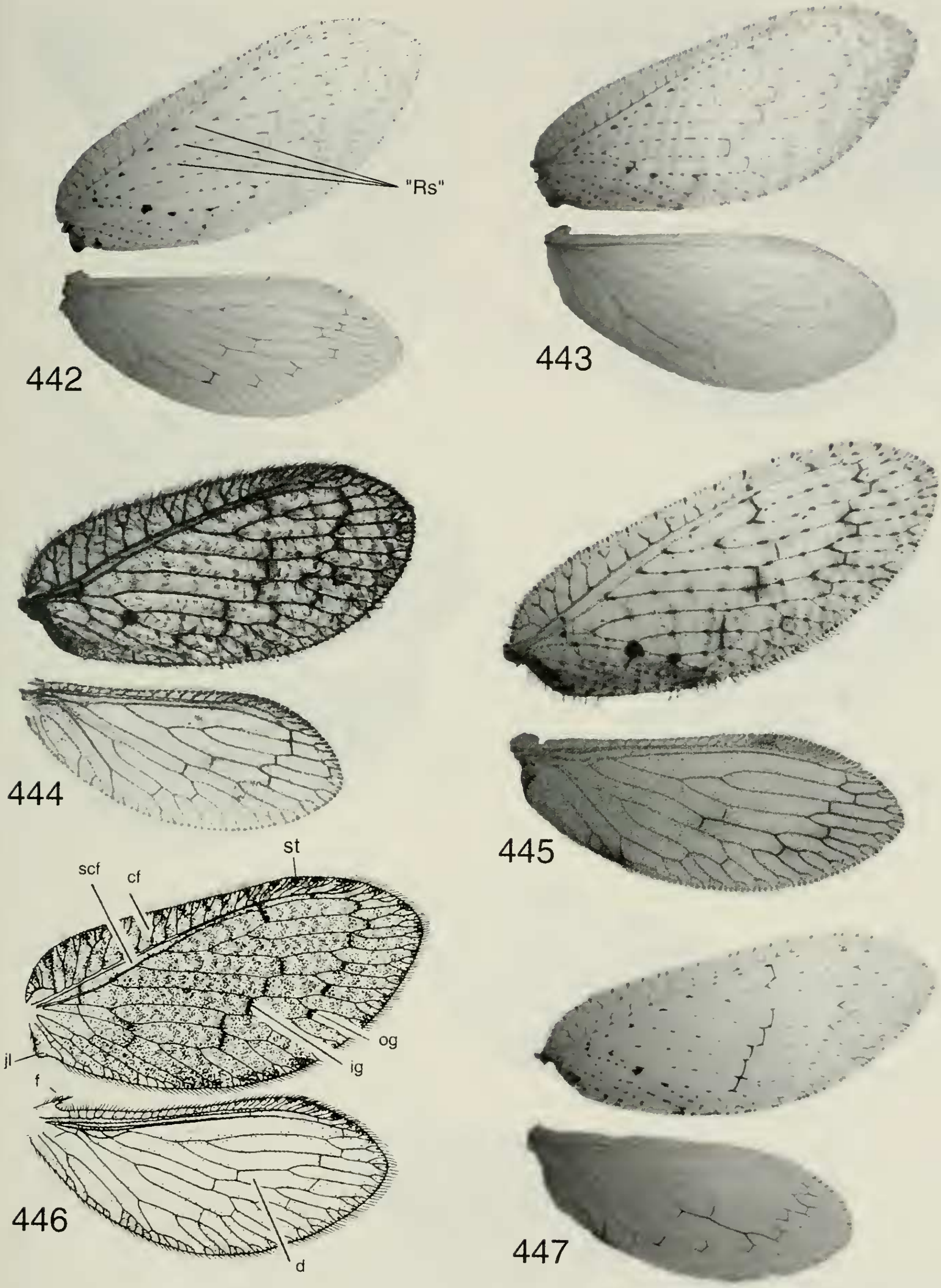
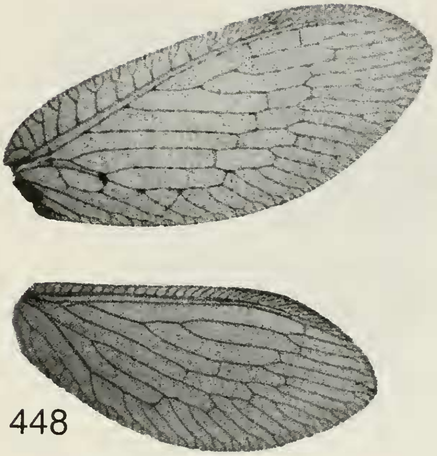
FIGURES 440–441. *Hemerobius* sp. base of fore- and hind wing. Fig. 440, forewing; Fig. 441, hind wing.



FIGURES 442–447. *Hemerobius* right fore- and hind wings. Fig. 442, *H. bolivari*; Fig. 443, *H. discretus*; Fig. 444, *H. edui*; Fig. 445, *H. gaitoi*; Fig. 446, *H. hernandezi*; Fig. 447, *H. jucundus*. (Photos and drawing from Monserrat, 1996)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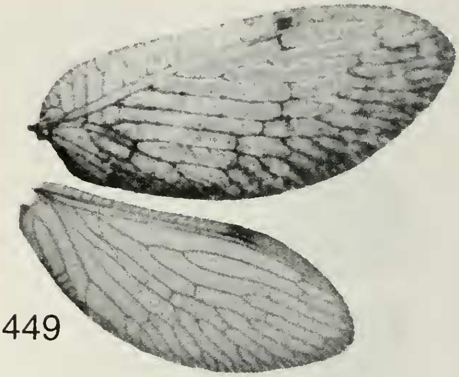
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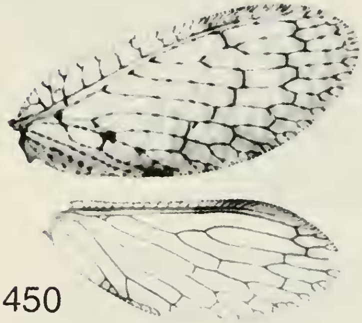
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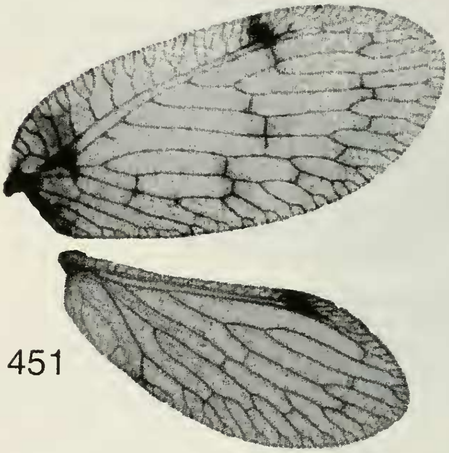
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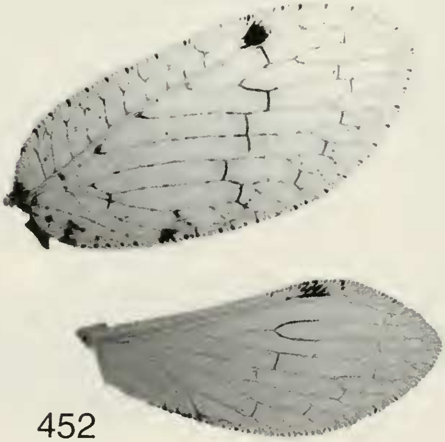
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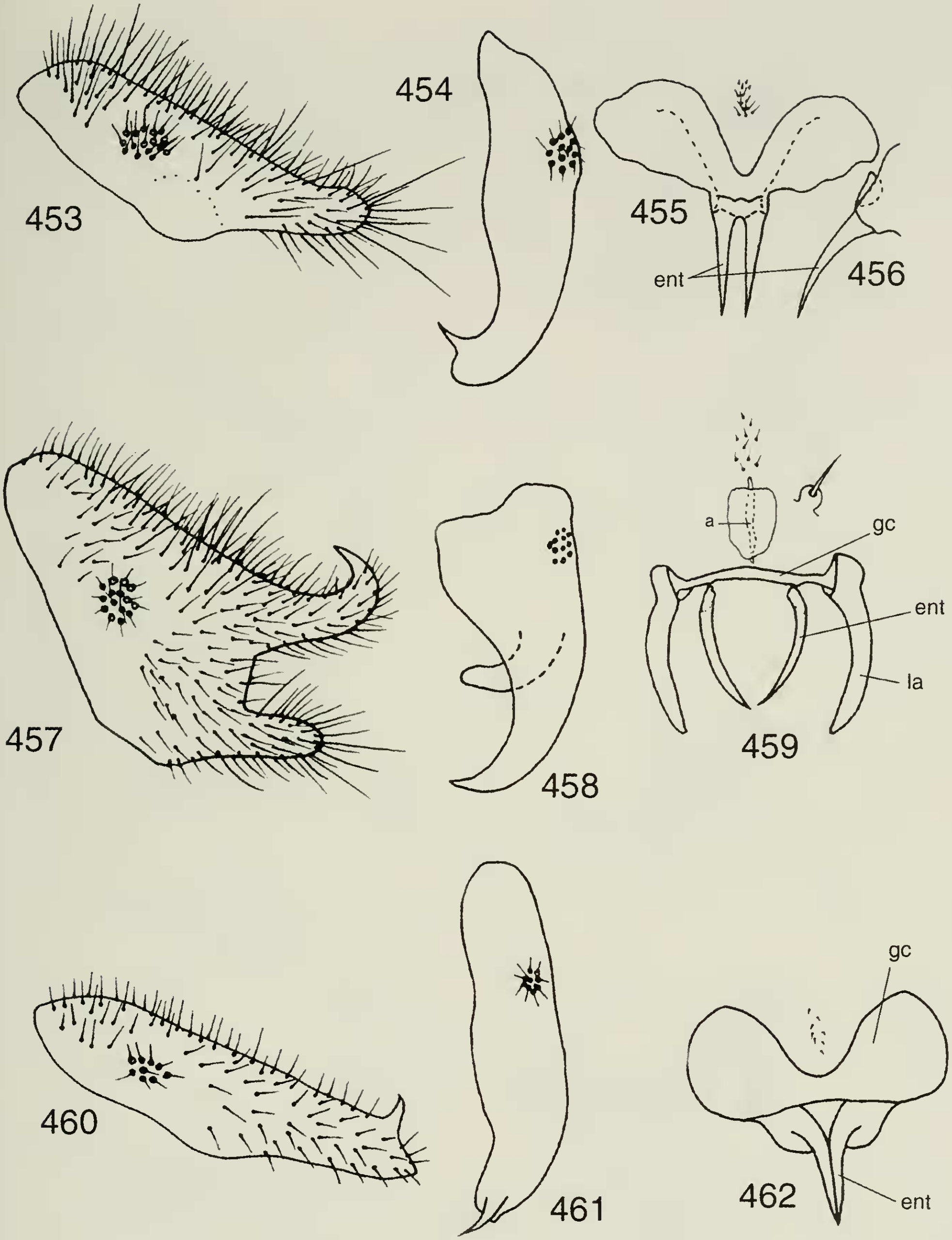
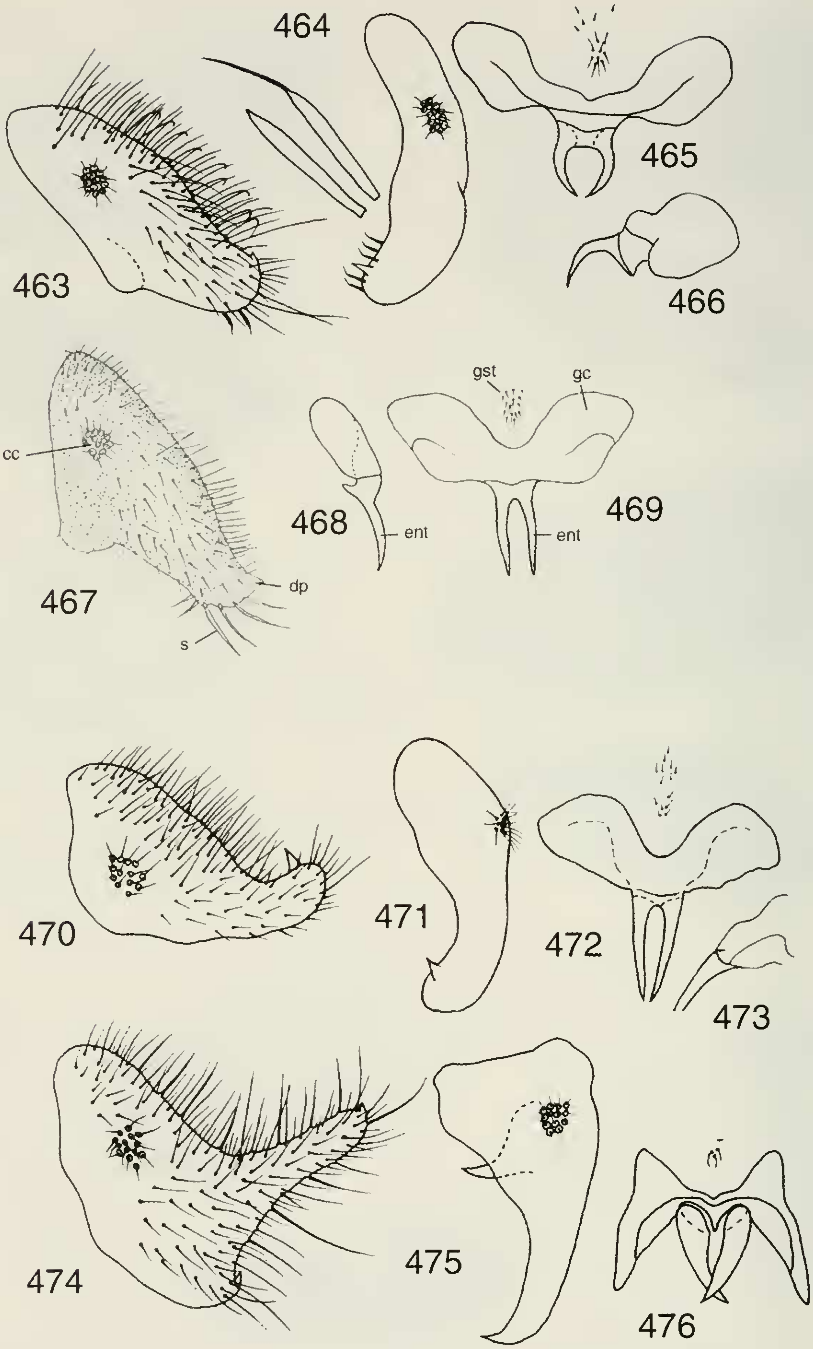
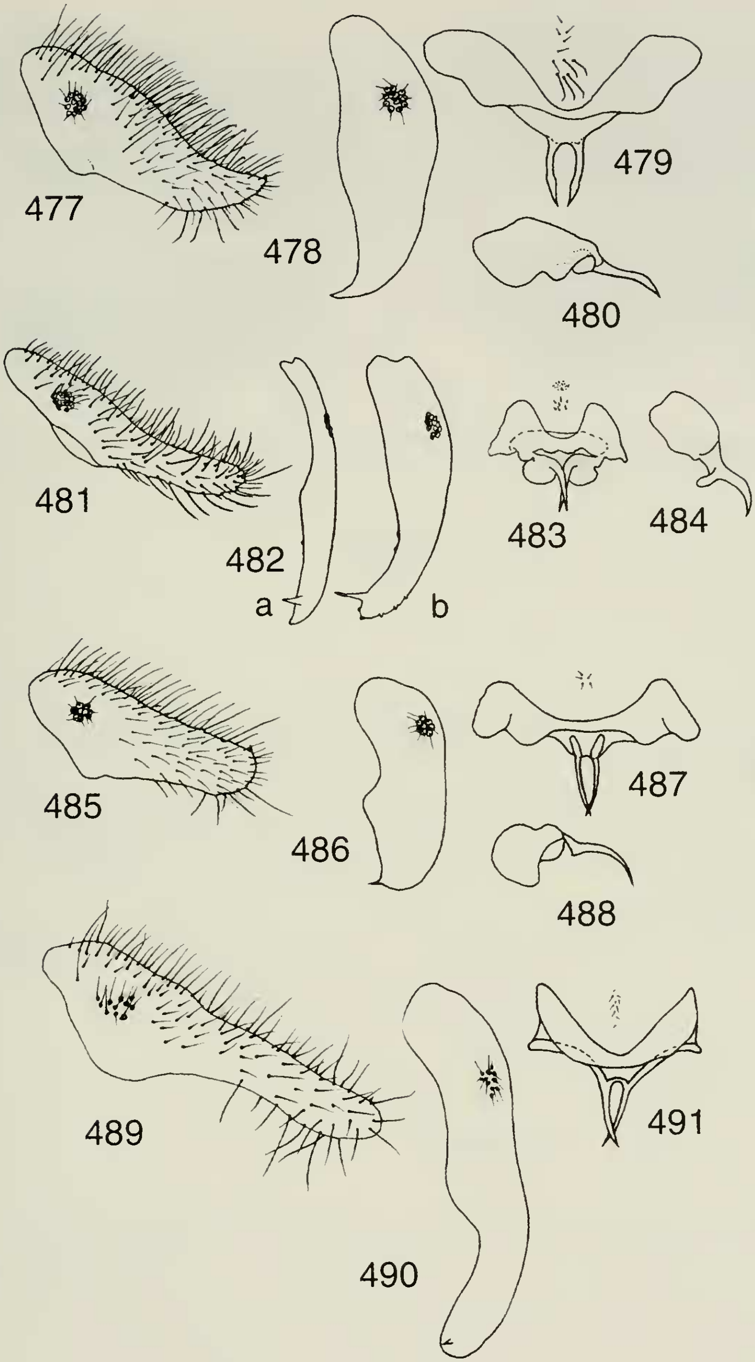
FIGURES 448–452. *Hemerobius* right fore- and hind wings. Fig. 448, *H. martinezae*; Fig. 449, *H. nigridorsus*; Fig. 450, *H. hirsuticornis*; Fig. 451, *H. pennii*; Fig. 452, *H. withycombei*. (Photos from Monserrat, 1996 and 1998)



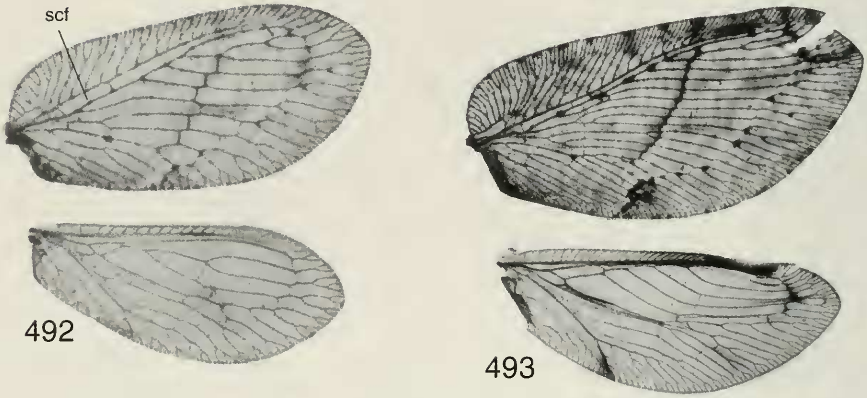
Figures 453–462. *Hemerobius* sp., male terminalia. Figs. 453–456, *H. bolivari* Banks. Fig. 453, ectoproct in lateral view; Fig. 454, ectoproct in dorsal view; Fig. 455, internal genitalia in dorsal view; Fig. 456, internal genitalia in lateral view. Figs. 457–459, *H. discretus* Navás. Fig. 457, ectoproct in lateral view; Fig. 458, ectoproct in dorsal view; Fig. 459, internal genitalia in dorsal view. Figs. 460–462, *H. edui* Monserrat. Fig. 460, ectoproct in lateral view; Fig. 461, ectoproct in dorsal view; Fig. 462, internal genitalia in dorsal view. e = edeagus. (Illustrations from Monserrat, 1996)



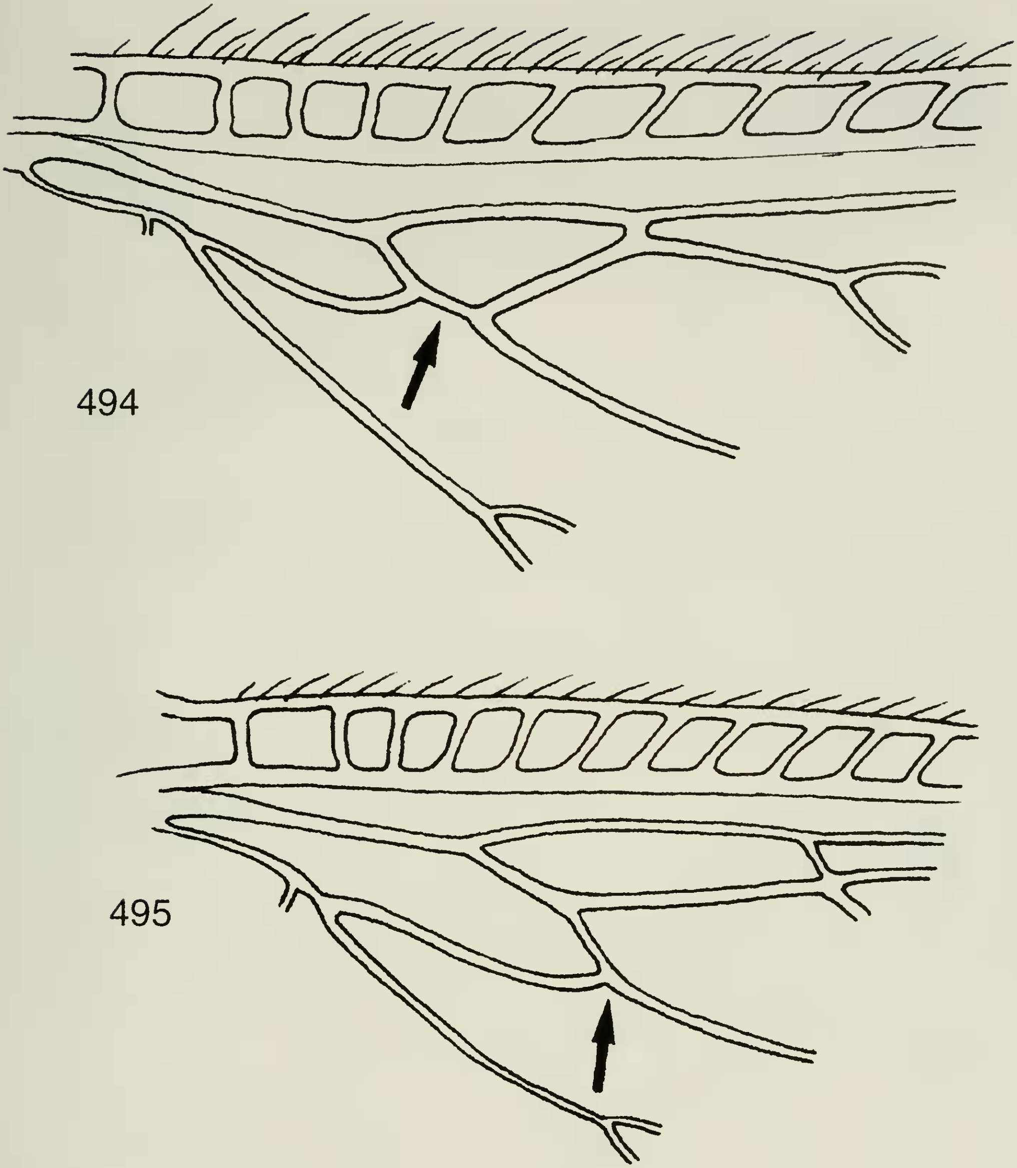
FIGURES 463–476. *Hemerobius sp.*, male terminalia. Figs. 463–466, *H. gaitoi* Monserrat. Fig. 463, ectoproct in lateral view; Fig. 464, ectoproct with terminal setae enlarged, in dorsal view; Fig. 465, internal genitalia in dorsal view; Fig. 466, internal genitalia in lateral view. Figs. 467–469, *H. hernandezi* Monserrat. Fig. 467, ectoproct in lateral view; Fig. 468, internal genitalia in lateral view; Fig. 469, internal genitalia in dorsal view. Figs. 470–473, *H. jucundus* Navás. Fig. 470, ectoproct in lateral view; Fig. 471, ectoproct in dorsal view; Fig. 472, internal genitalia in dorsal view; Fig. 473, internal genitalia in lateral view. Figs. 474–476, *H. martinezae* Monserrat. Fig. 474, ectoproct in lateral view; Fig. 475, ectoproct in dorsal view; Fig. 476, internal genitalia in dorsal view. en = entoprocessus, g = gonarcus, gs = gonosetae. (Illustrations from Monserrat, 1996)



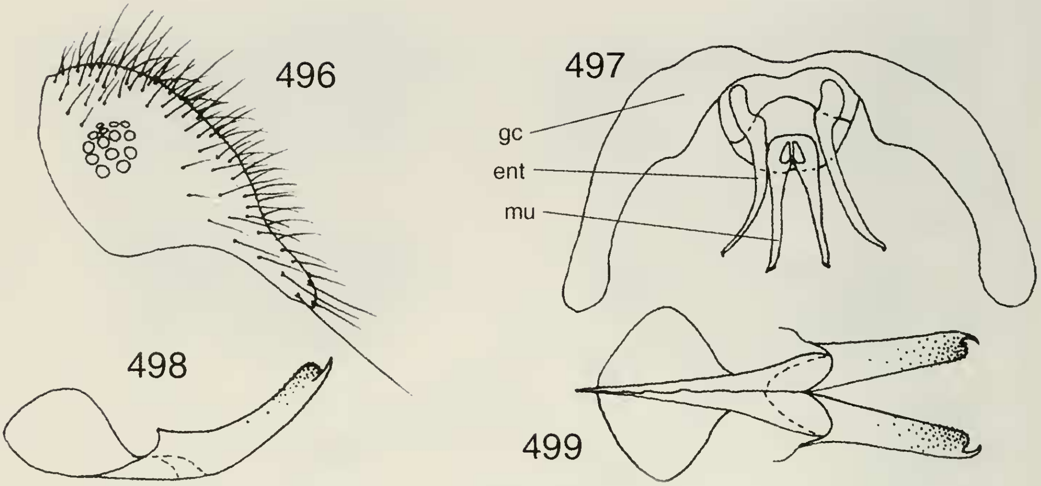
FIGURES 477–491. *Hemerobius* sp., male terminalia. Figs. 477–480, *H. nigridorsus* Monserrat. Fig. 477, ectoproct in lateral view; Fig. 478, ectoproct in dorsal view; Fig. 479, internal genitalia in dorsal view; Fig. 480, internal genitalia in lateral view. Figs. 481–484, *H. hirsuticornis* Monserrat. Fig. 481, ectoproct in lateral view; Fig. 482, ectoproct in dorso-lateral view; Fig. 483, internal genitalia in dorsal view; Fig. 484, internal genitalia in lateral view. Figs. 485–488, *H. pennii* Monserrat. Fig. 485, ectoproct in lateral view; Fig. 486, ectoproct in dorsal view; Fig. 487, internal genitalia in dorsal view; Fig. 488, internal genitalia in lateral view. Figs. 489–491, *H. withycombei* (Kimmins). Fig. 489, ectoproct in lateral view; Fig. 490, ectoproct in dorsal view; Fig. 491, internal genitalia in dorsal view. (Illustrations from Monserrat, 1996 and 1998)



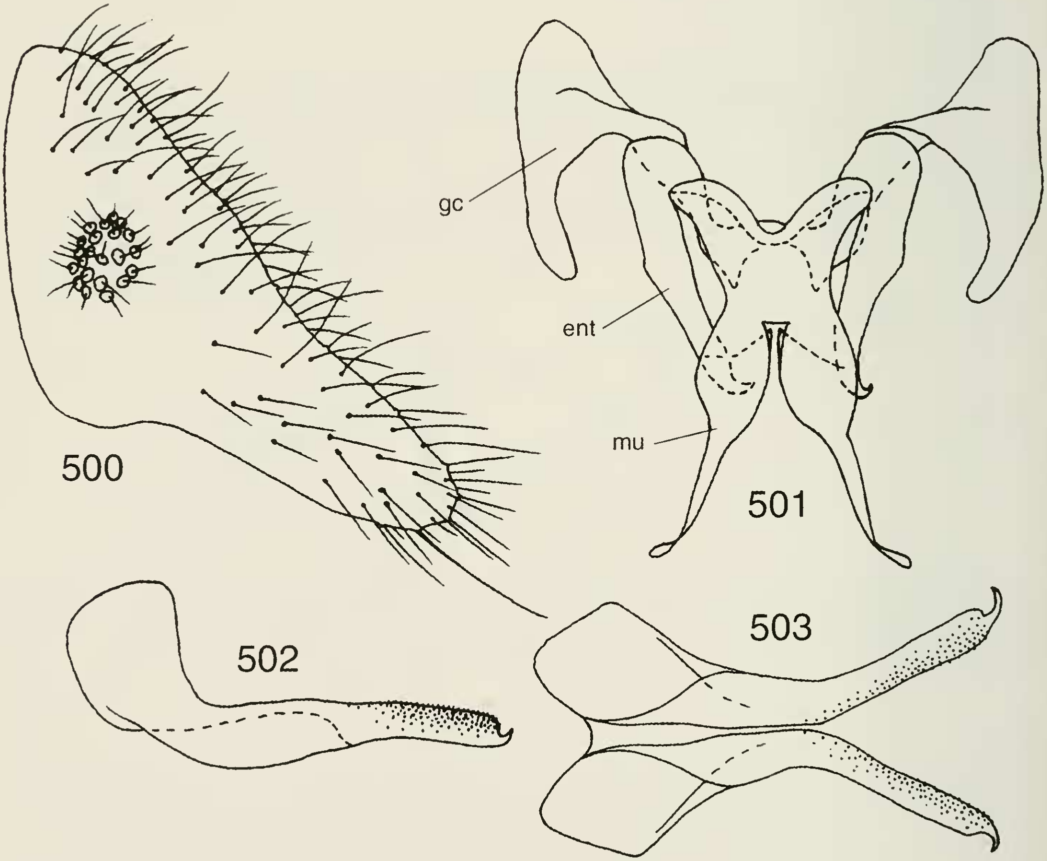
FIGURES 492–493. Right fore- and hind wings. Fig. 492, *Megalomus minor* Banks; Fig. 493, *Megalomus pictus* Hagen.



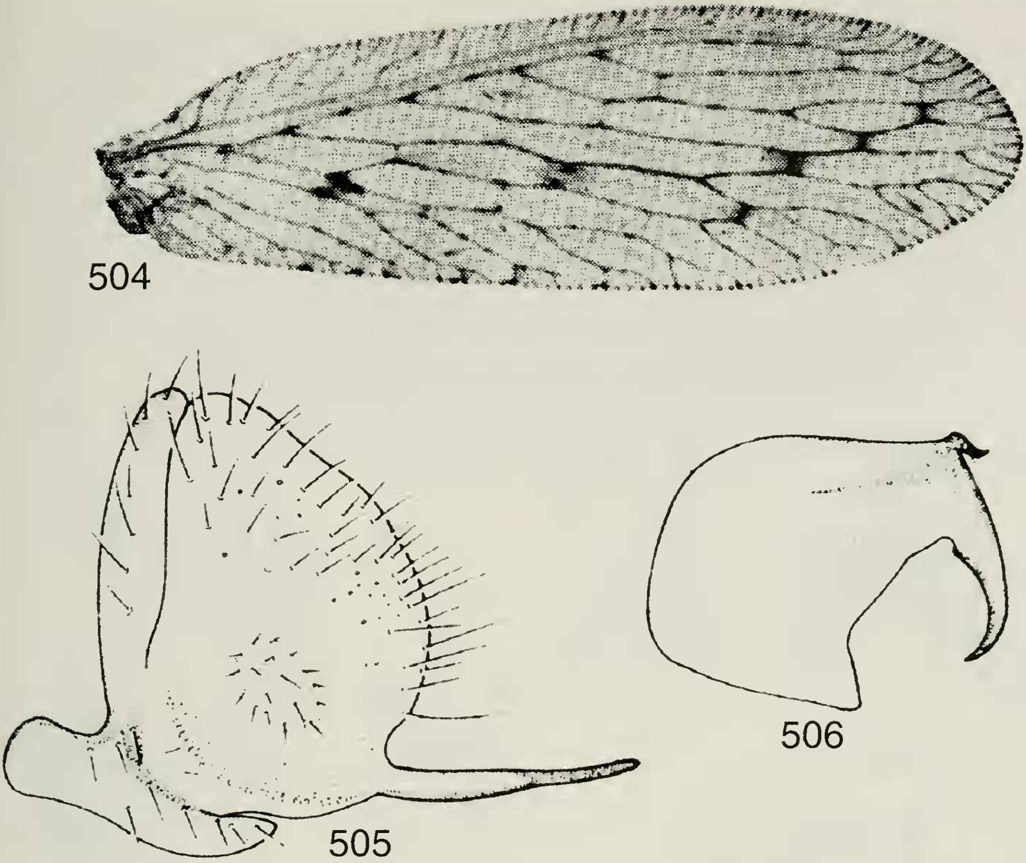
FIGURES 494–495. Base of right hind wing. Fig. 494, *Megalomus minor* Banks; Fig. 495, *Megalomus pictus* Hagen. (Illustrations from Monserrat, 1997)



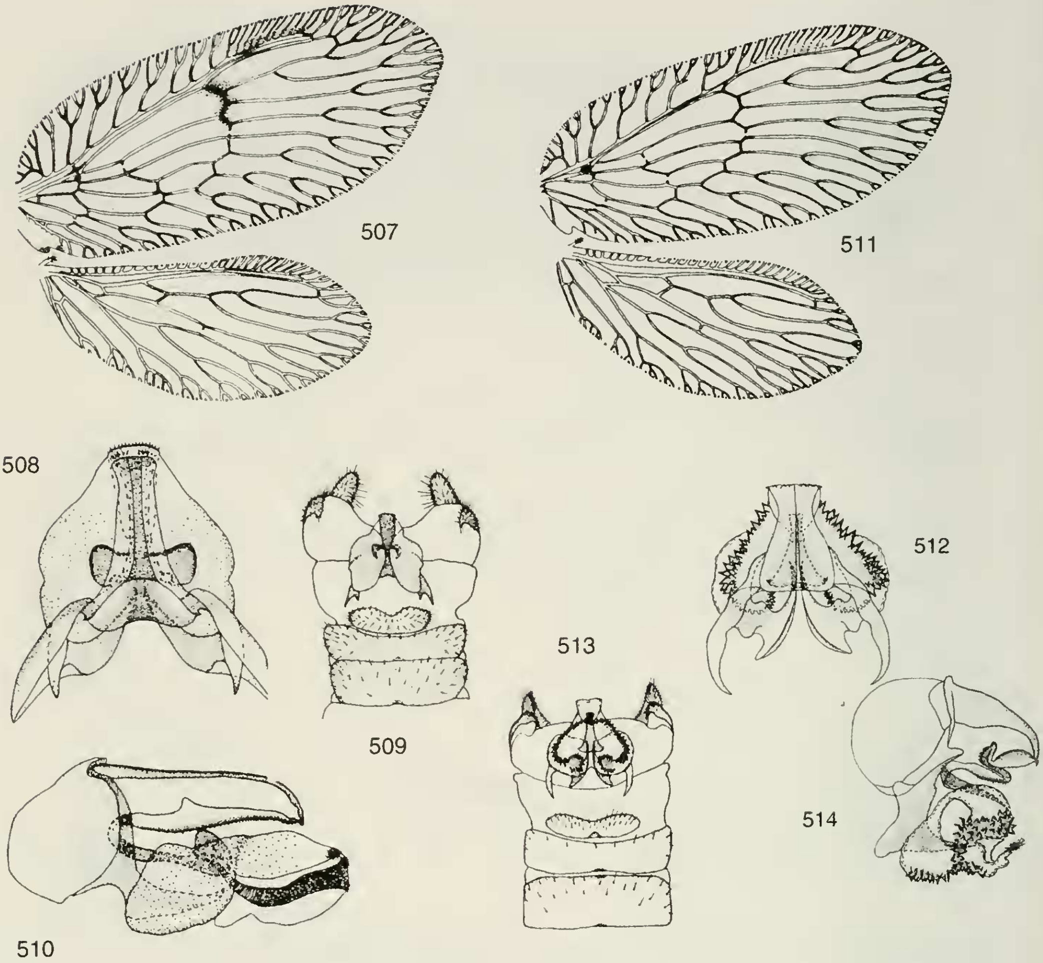
FIGURES 496–499. *Megalomus minor* Banks. Fig. 496, male ectoproct in lateral view; Fig. 497, male gonarcus in caudal view; Fig. 498, paramere in lateral view; Fig. 499, parameres in dorsal view. (Illustrations from Monserrat, 1997)



FIGURES 500–503. *Megalomus pictus* Hagen. Fig. 500, male ectoproct in lateral view; Fig. 501, male internal genitalia in dorsal view; Fig. 502, male parameres in lateral view; Fig. 503, male parameres in dorsal view. (Illustrations from Monserrat, 1997)



FIGURES 504–506. *Micromus subanticus* (Walker). Fig. 504, right forewing; Fig. 505, male ectoproct in lateral view; Fig. 506, male gonarcus in lateral view. (Reprinted from Carpenter (1940) (504) and drawn by Victor Monserrat (505, 506)]



Figures 507–514. *Notiobiella rubrostigma* Navás. Fig. 507, right fore- and hind wings; Fig. 508, internal male genitalia in ventral view; Fig. 509, male abdomen in ventral view; Fig. 510, internal male genitalia in lateral view. *Notiobiella mexicana* Banks. Fig. 511, right fore- and hind wings; Fig. 512, male internal genitalia in ventral view; Fig. 513, male abdomen in ventral view; Fig. 514, male internal genitalia in lateral view. (Illustrations by Victor Monserrat)

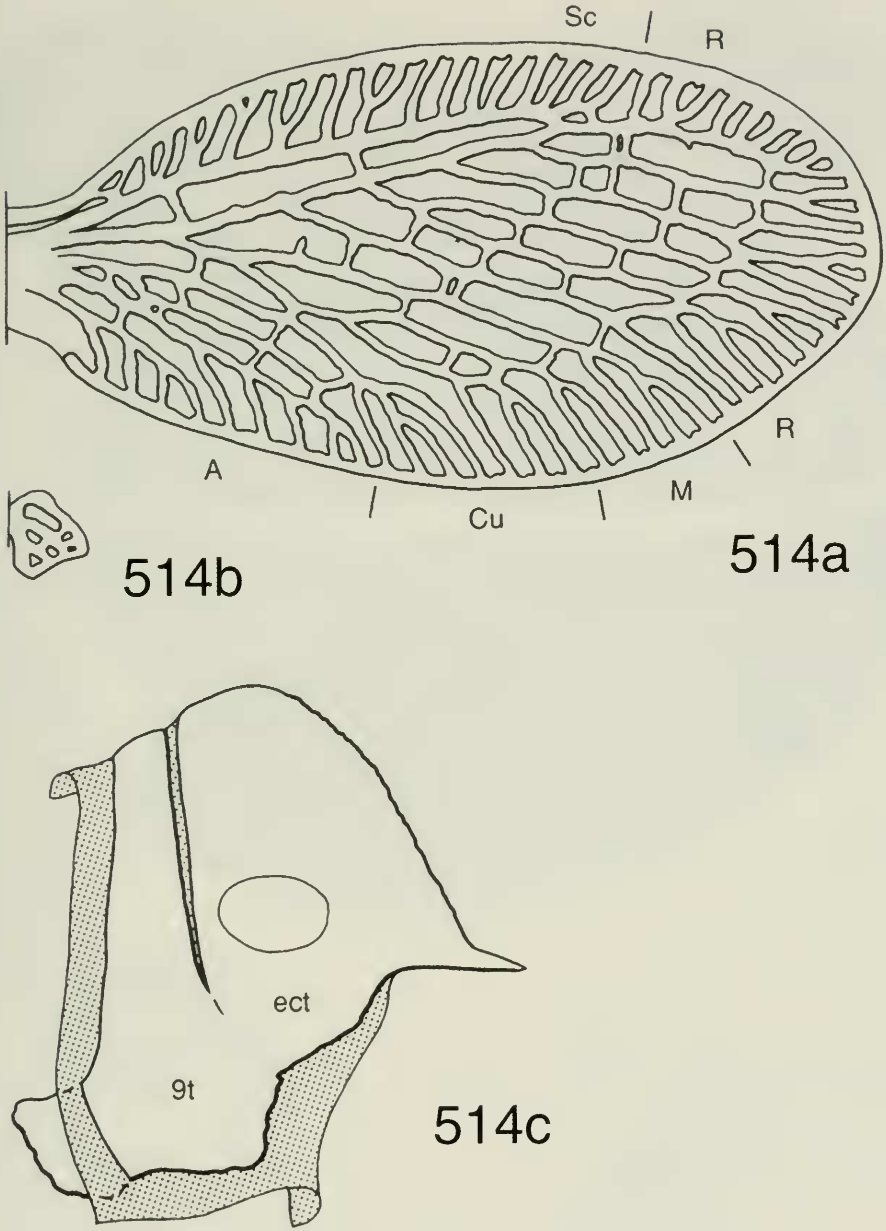
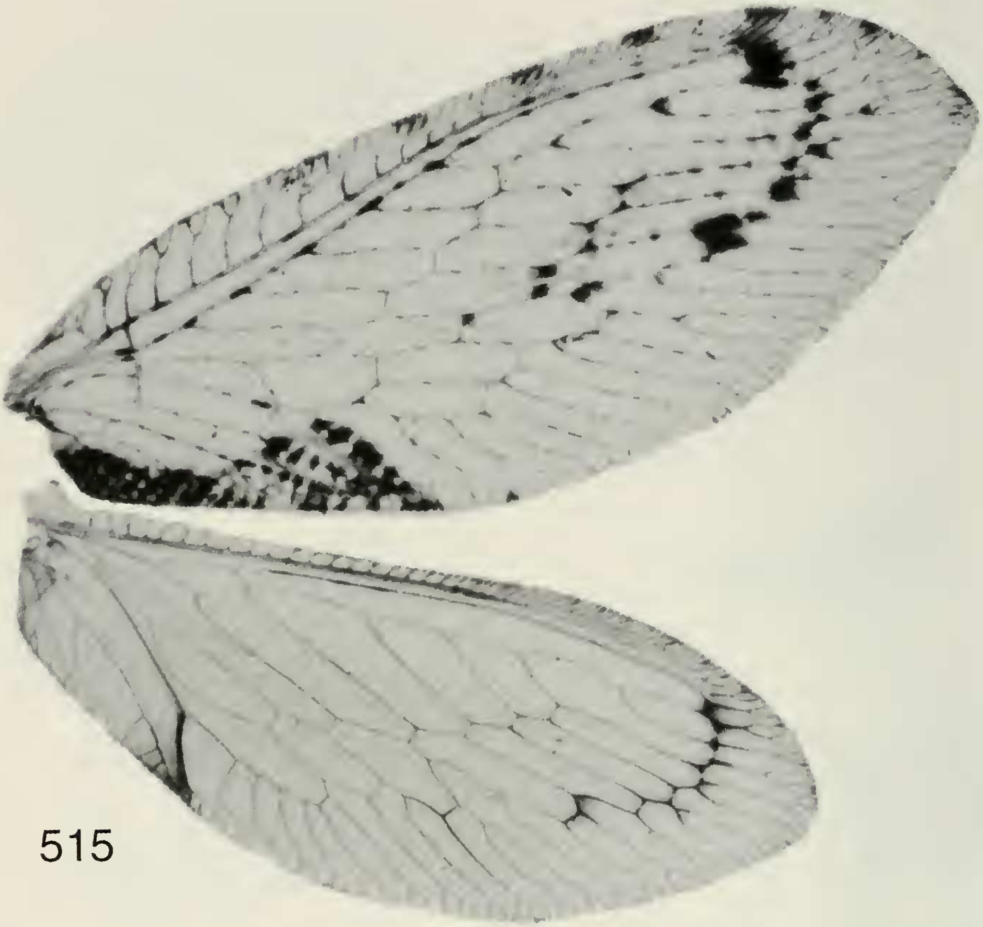


FIGURE 514a–c. *Nusalala brachyptera* Oswald. Fig. 514a, forewiing; Fig. 514b, hind wing; Fig. 514c, male ectoproct. (Reprinted with permission of Systematic Entomology)



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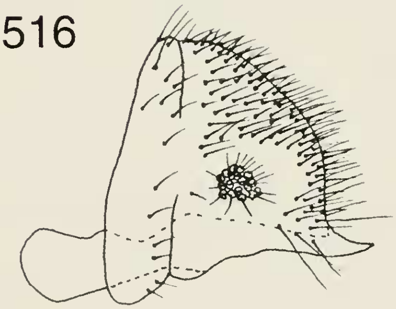

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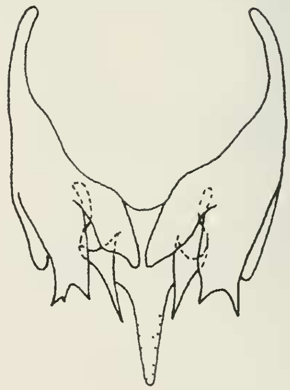
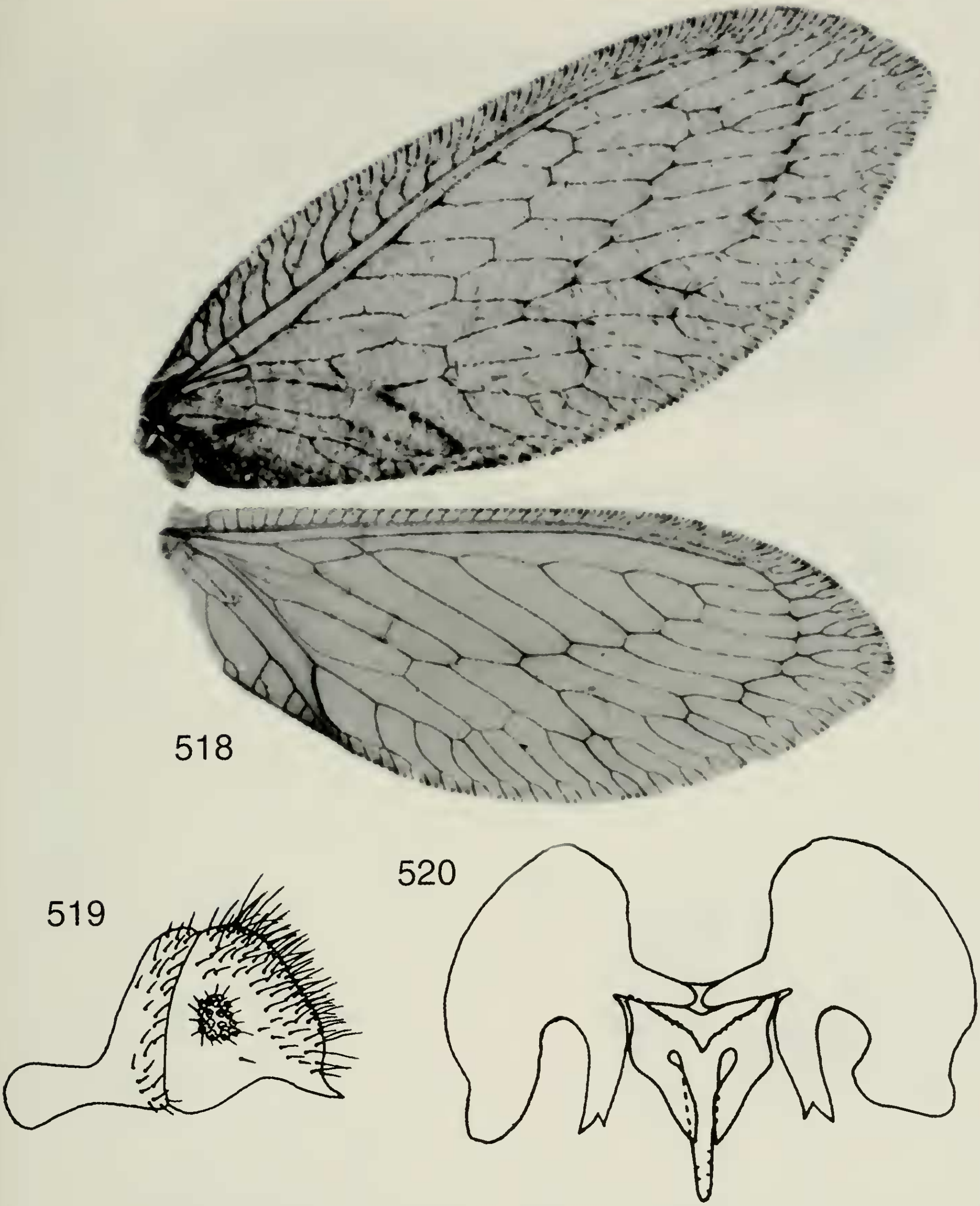
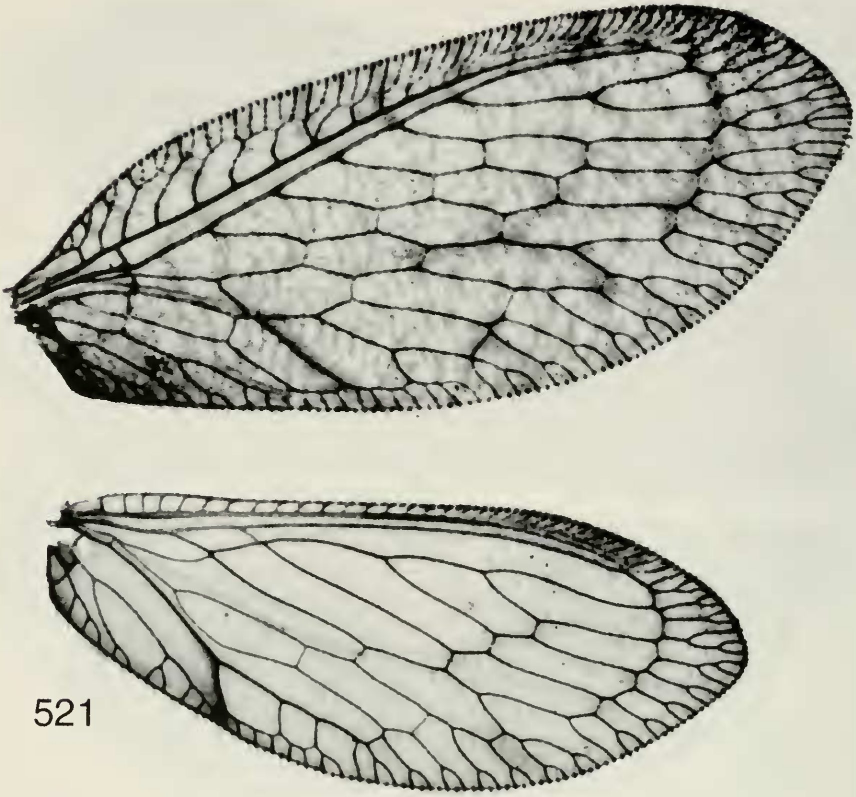


FIGURES 515–517. *Nusalala championi* Kimmins. Fig. 515, right fore- and hind wings; Fig. 516, male ectoproct in lateral view; Fig. 517, male internal genitalia in caudal view. [Reprinted from Monserrat (2000)]



FIGURES 518–520. *Nusalala ghioi* Monserrat. Fig. 518, right fore- and hind wings; Fig. 519, male ectoproct in lateral view; Fig. 520, male internal genitalia in caudal view. [Reprinted from Monserrat (2000)]



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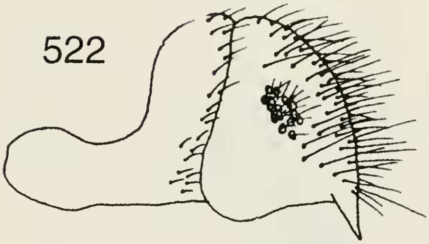

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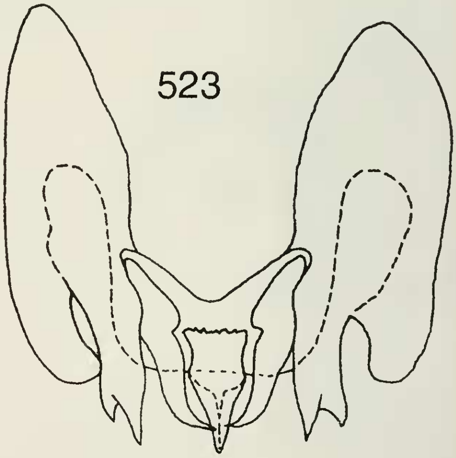

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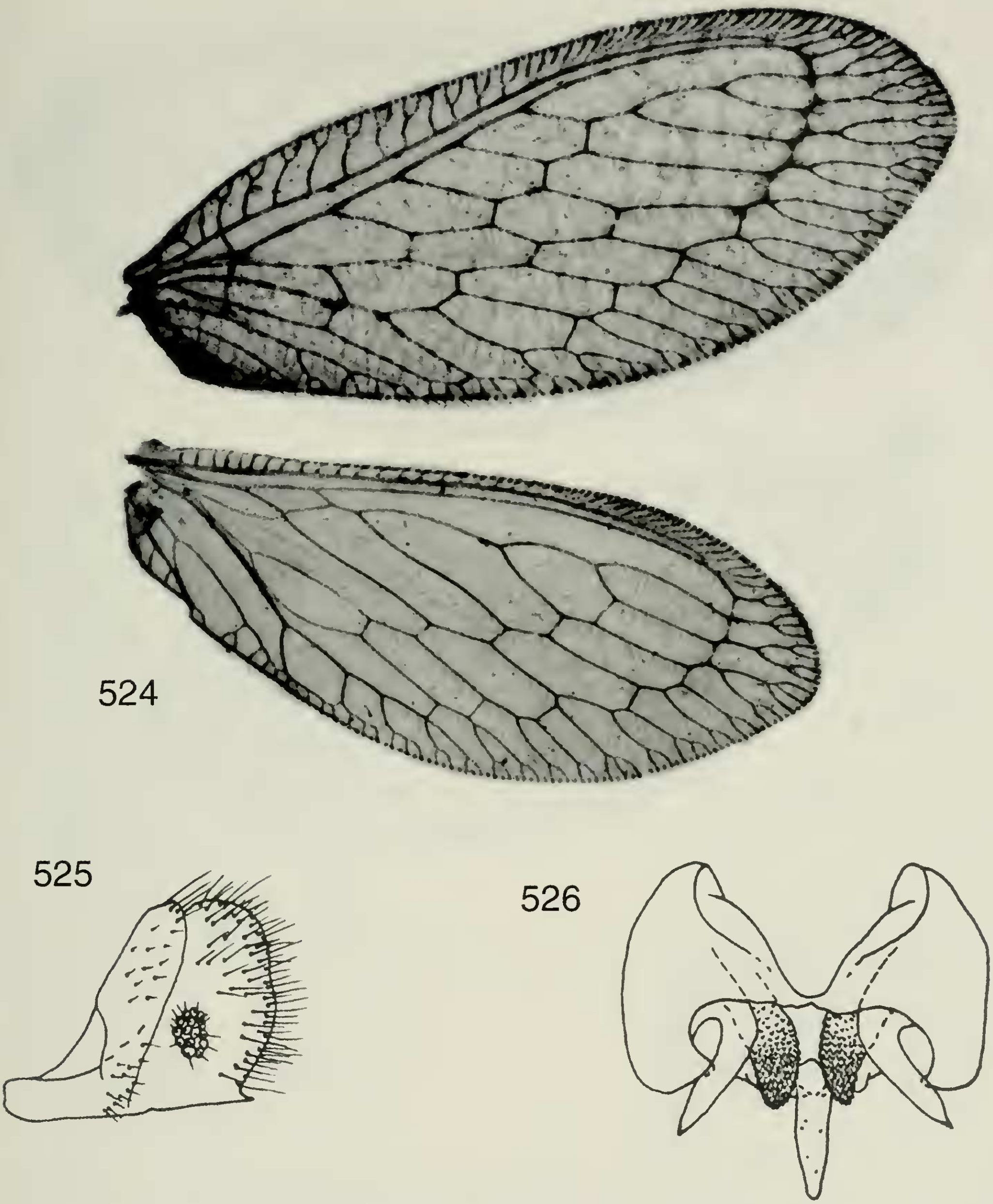
FIGURES 521–523. *Nusalala irrebita* (Navás). Fig. 521, right fore- and hind wings; Fig. 522, male ectoproct in lateral view; Fig. 523, male internal genitalia in caudal view. [Reprinted from Monserrat (2000)]



FIGURES 524–526. *Nusalala tessellata* (Gerstaecker). Fig. 524, right fore- and hind wings; Fig. 525, male ectoproct in lateral view; Fig. 526, male internal genitalia in caudal view. [Reprinted from Monserrat (2000)]

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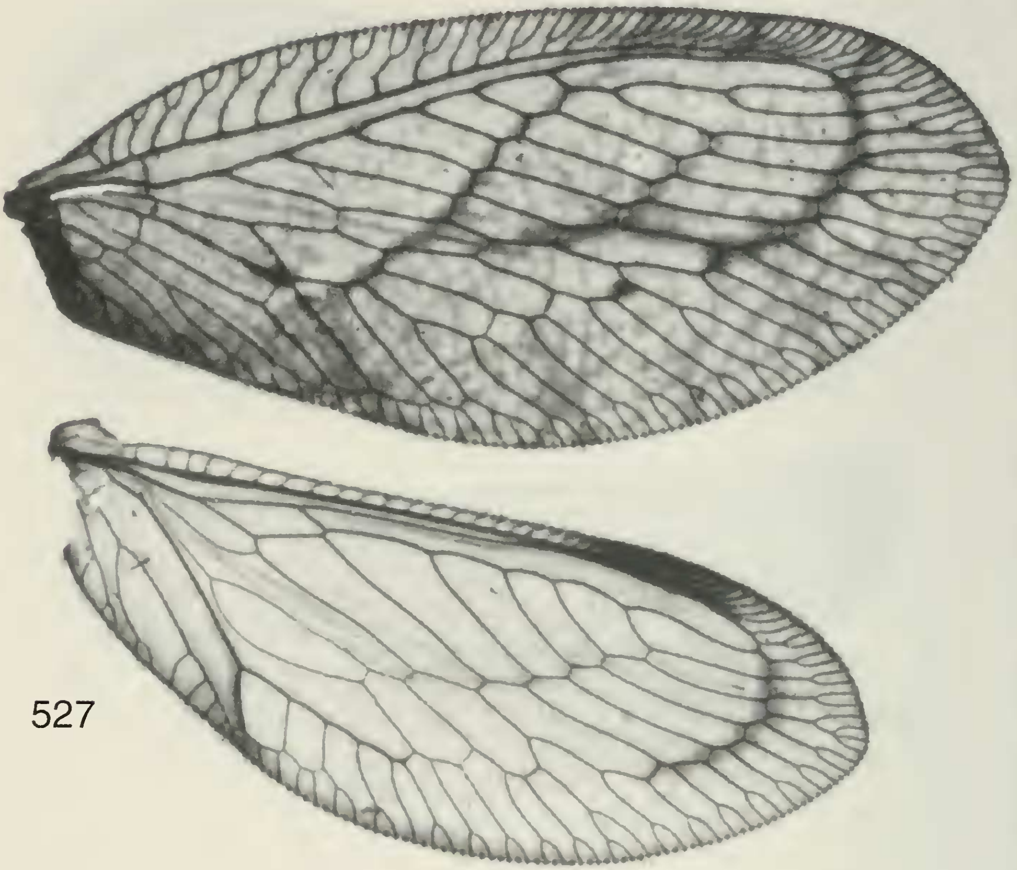

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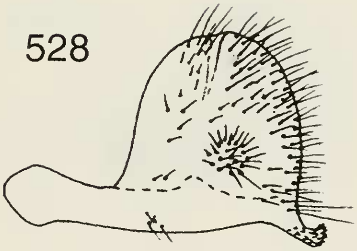

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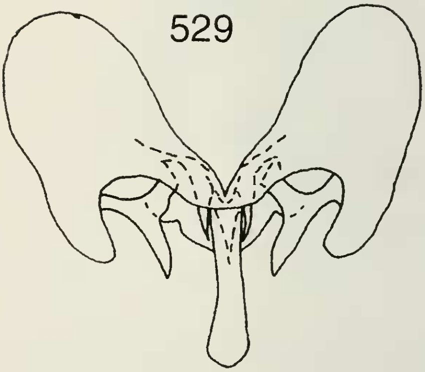
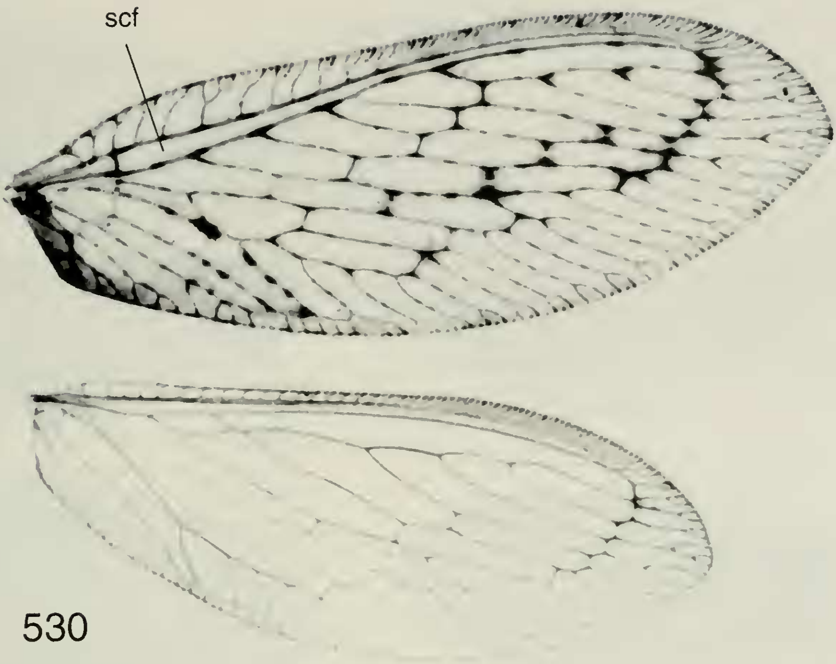


FIGURES 527–529. *Nusalala uncata* Kimmins. Fig. 527, right fore- and hind wings; Fig. 528, male ectoproct in lateral view; Fig. 529, male internal genitalia in caudal view. [Reprinted from Monserrat (2000)]



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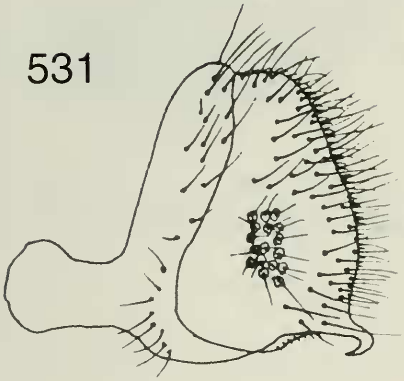

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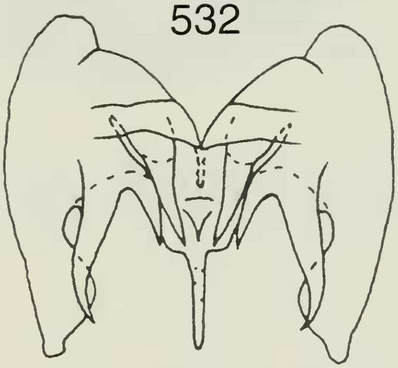
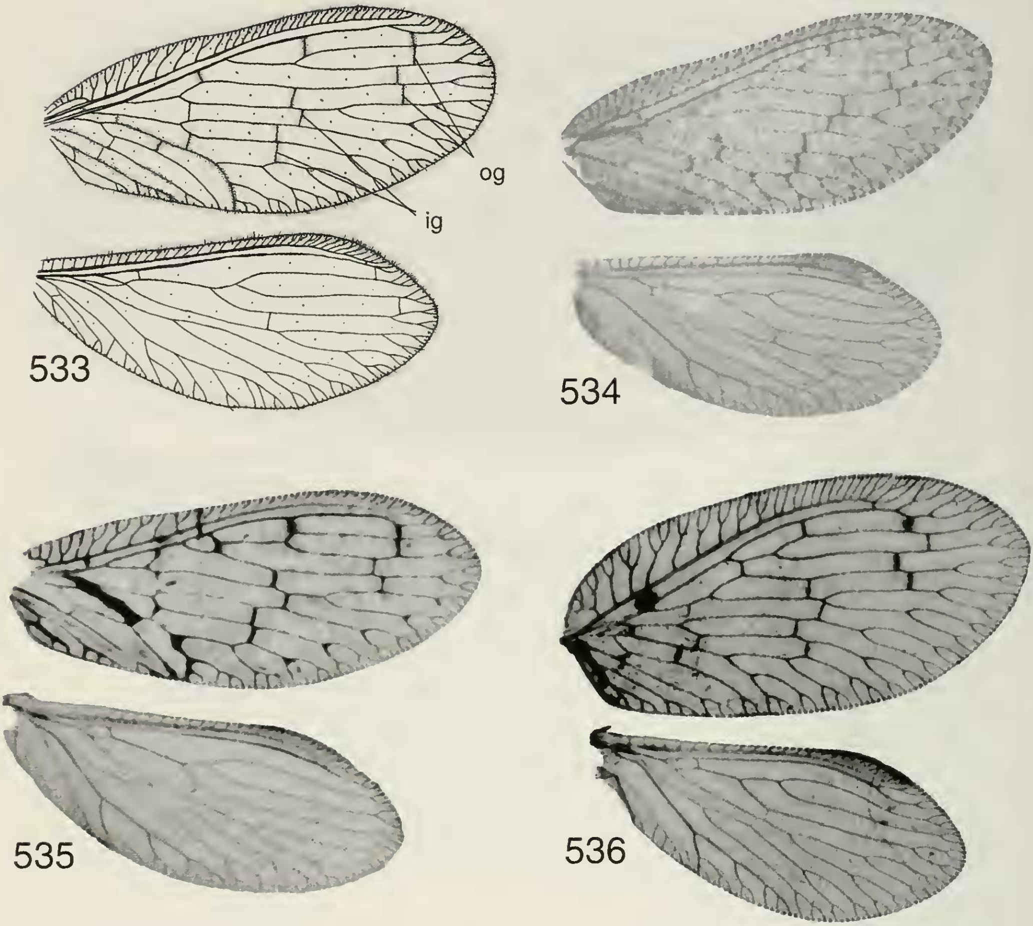
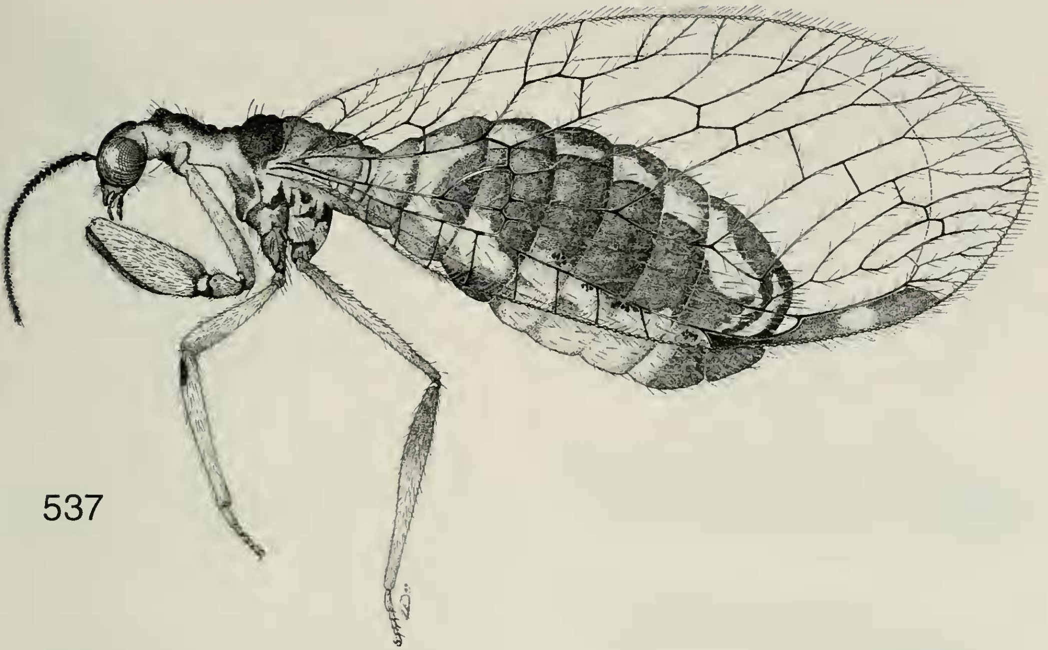


FIGURES 530–532. *Nusalala unguicaudata* Monserrat. Fig. 530, right fore- and hind wings; Fig. 531, male ectoproct in lateral view; Fig. 532, male internal genitalia in caudal view. [Rreprinted from Monserrat (2000)]



FIGURES 533–536. Right fore- and hind wings. Fig. 533, *Sympherobius angustus* (Banks); Fig. 534, *Sympherobius arizonicus* Banks; Fig. 535; *Sympherobius similis* Carpenter; Fig. 536, *Sympherobius subcostalis* Monserrat. (Fig. 535 shows aberrant third "Rs"). [Illustrations by Norman Penny (533) and photos by Victor Monserrat (534–536)]



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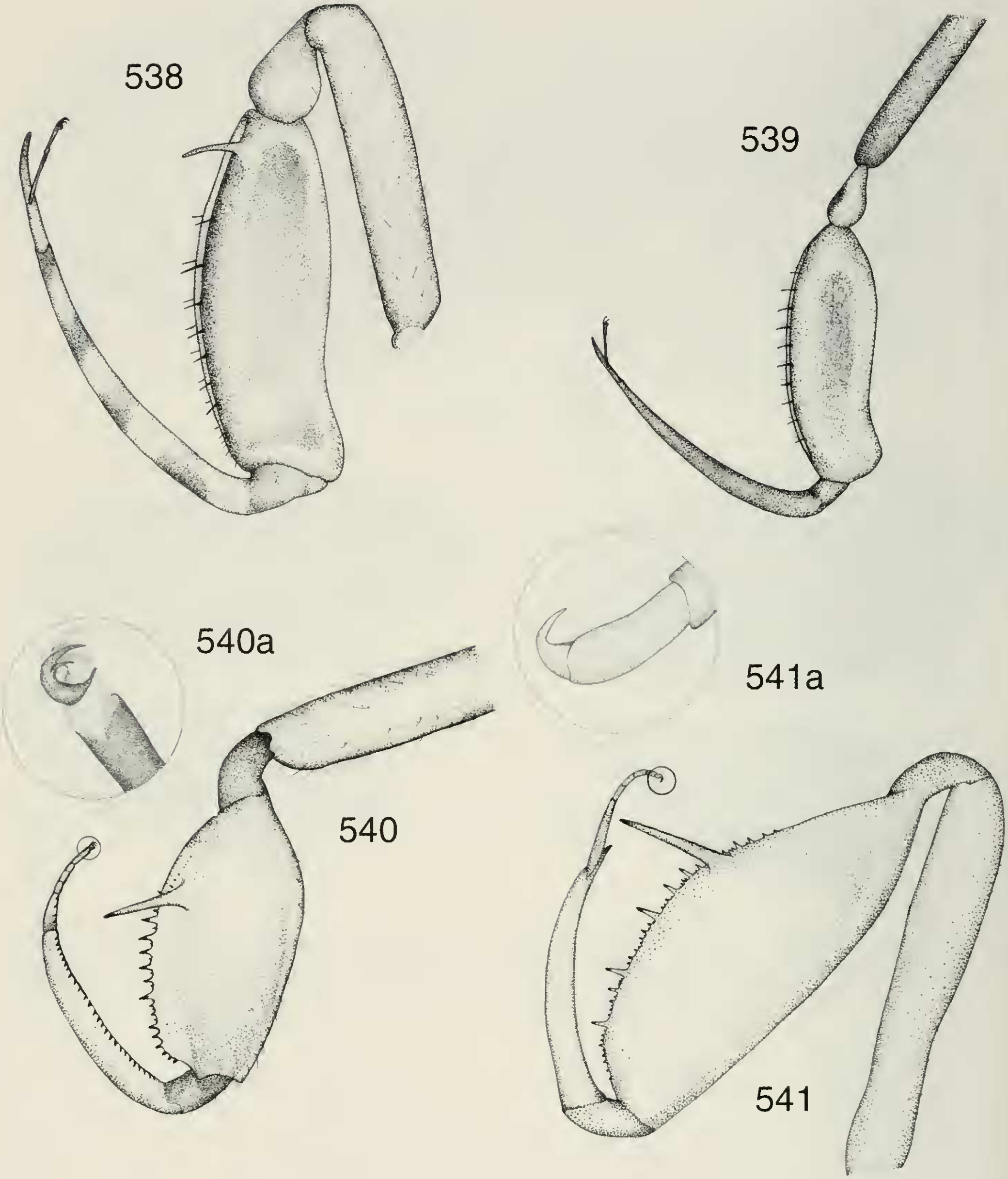
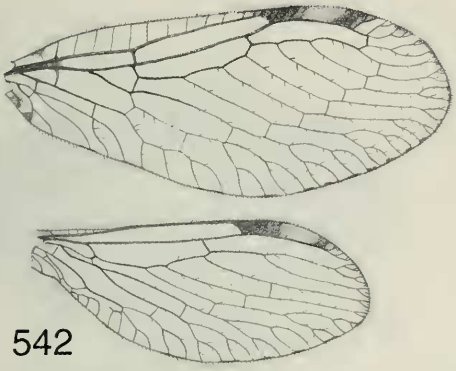
FIGURES 537. *Trichoscelia remipes* (Gerstaecker), habitus view. (Illustration by Artêmio Coelho da Silva)



FIGURES 538–541. Foreleg in lateral view. Fig. 538, *Plega hagenella* (Westwood); Fig. 539, *Trichoscelia remipes* (Gerstaecker); Fig. 540, *Nolima infensus* Navás; Fig. 541, *Zeugomantispa viridula* (Erichson).(Illustrations by Fred Ehrman)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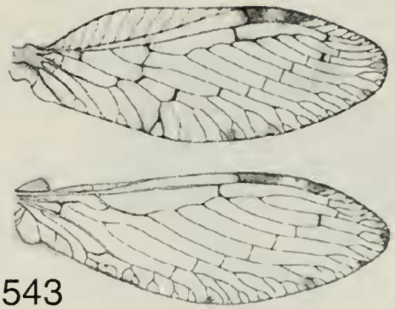
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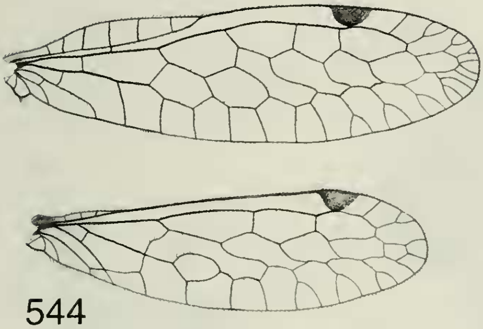
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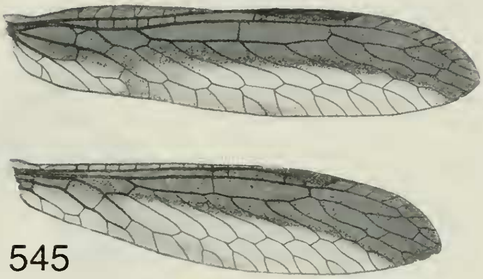
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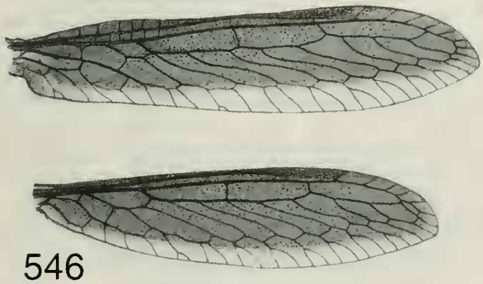
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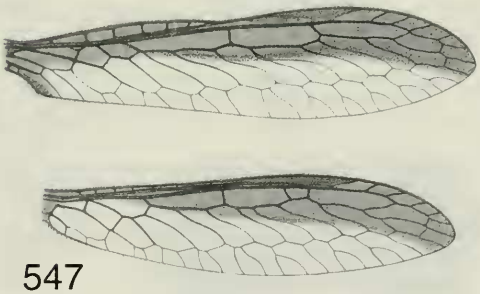
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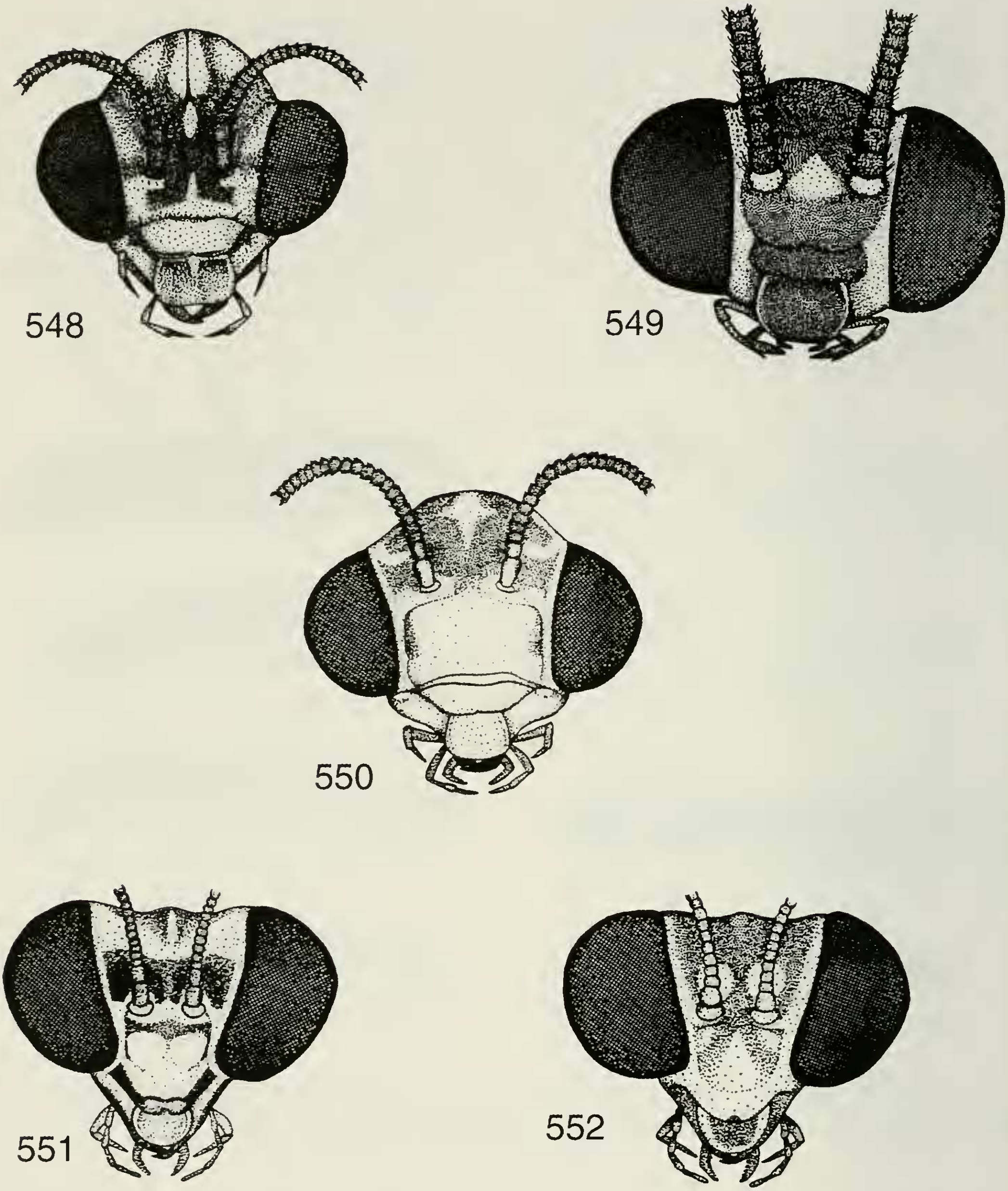
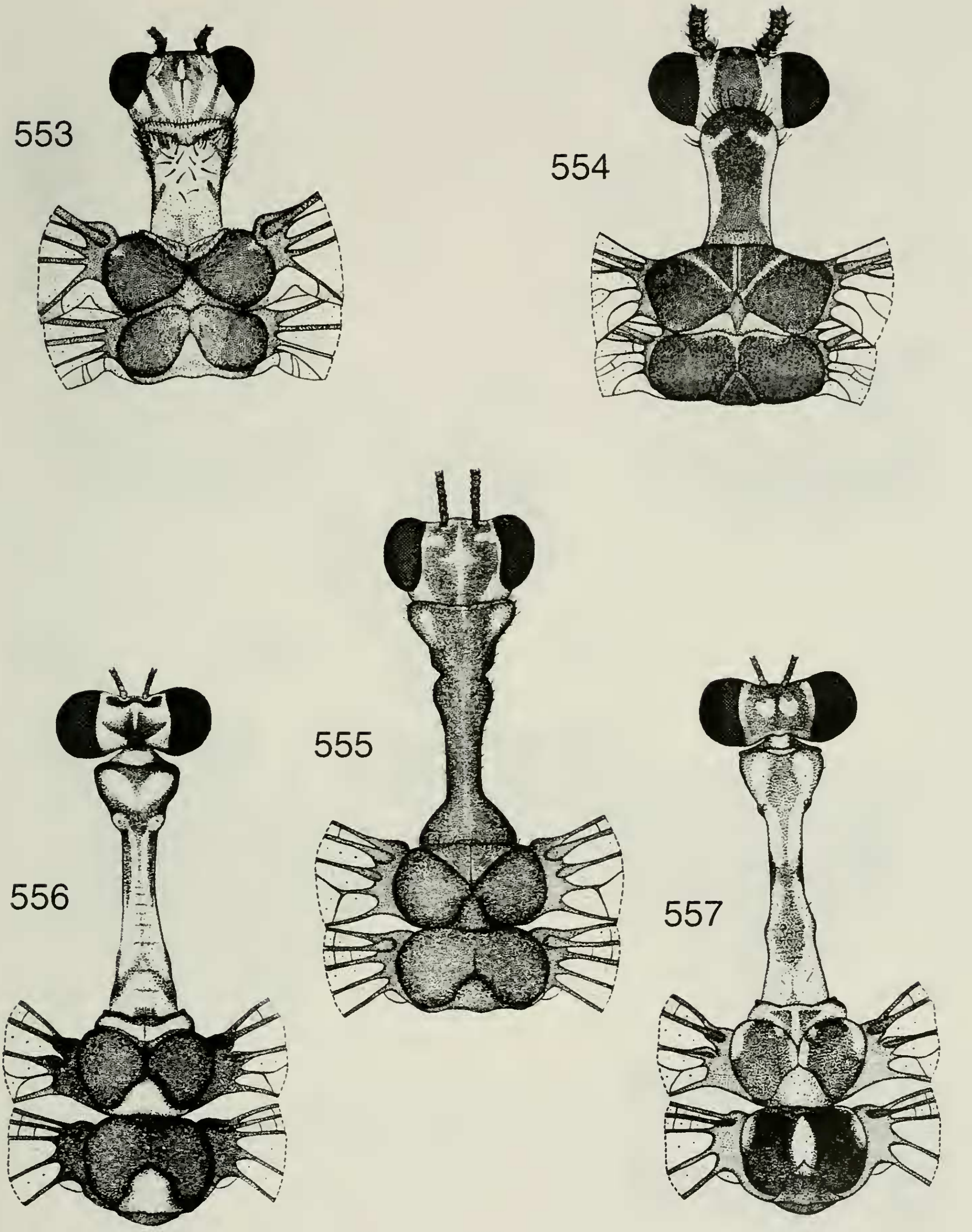
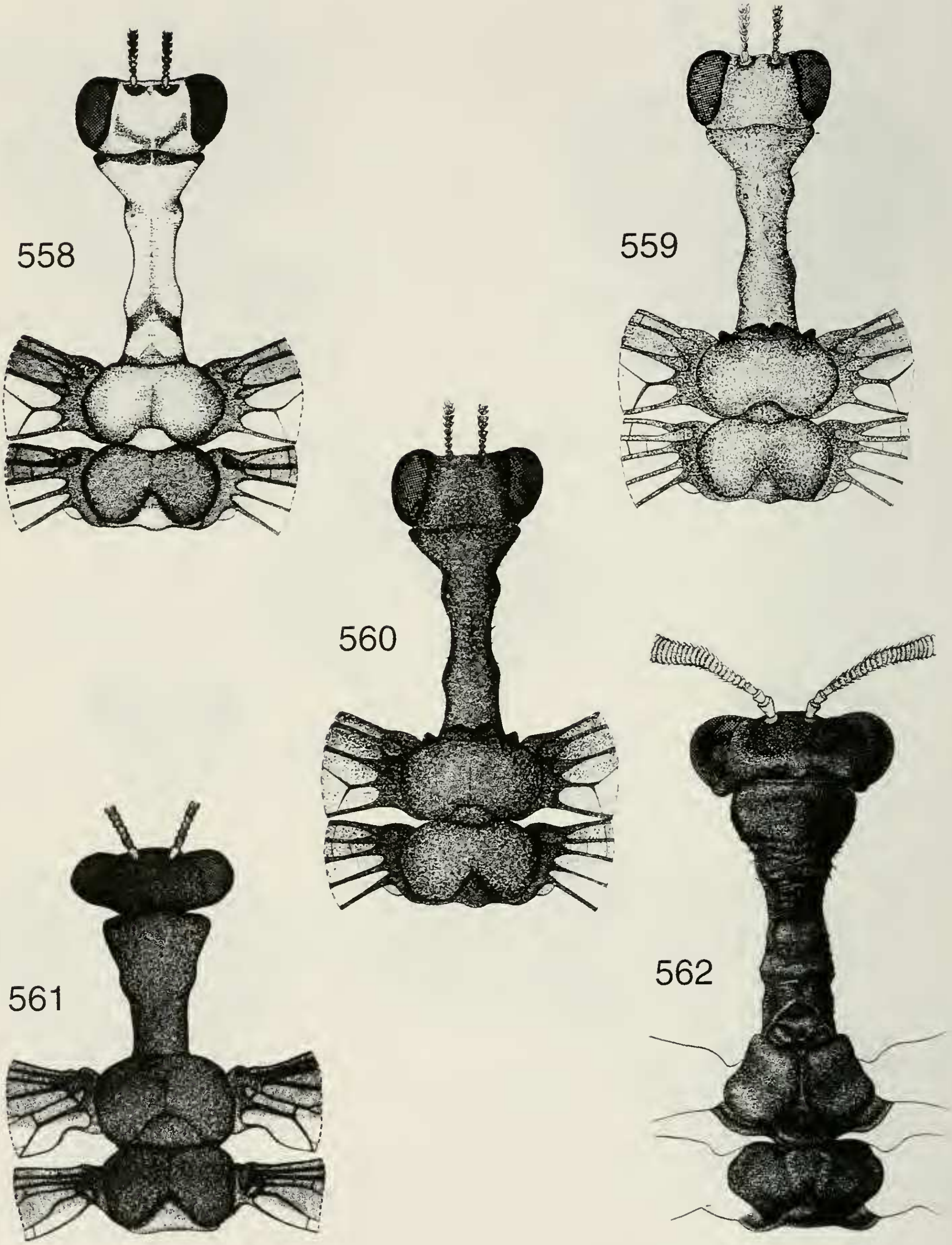
FIGURES 542–547. Right fore- and hind wings. Fig. 542, *Trichoscelia remipes* (Gerstaecker); Fig. 543, *Plega hagenella* (Westwood); Fig. 544, *Nolima infensus* Navás; Fig. 545, *Climaciella brunnea* (Say); Fig. 546, *Climaciella obtusa* Hoffman; Fig. 547, *Climaciella porosa* Hoffman. [Illustrations by Fred Ehrman (542–546) and Virginia Kirsch (547)]



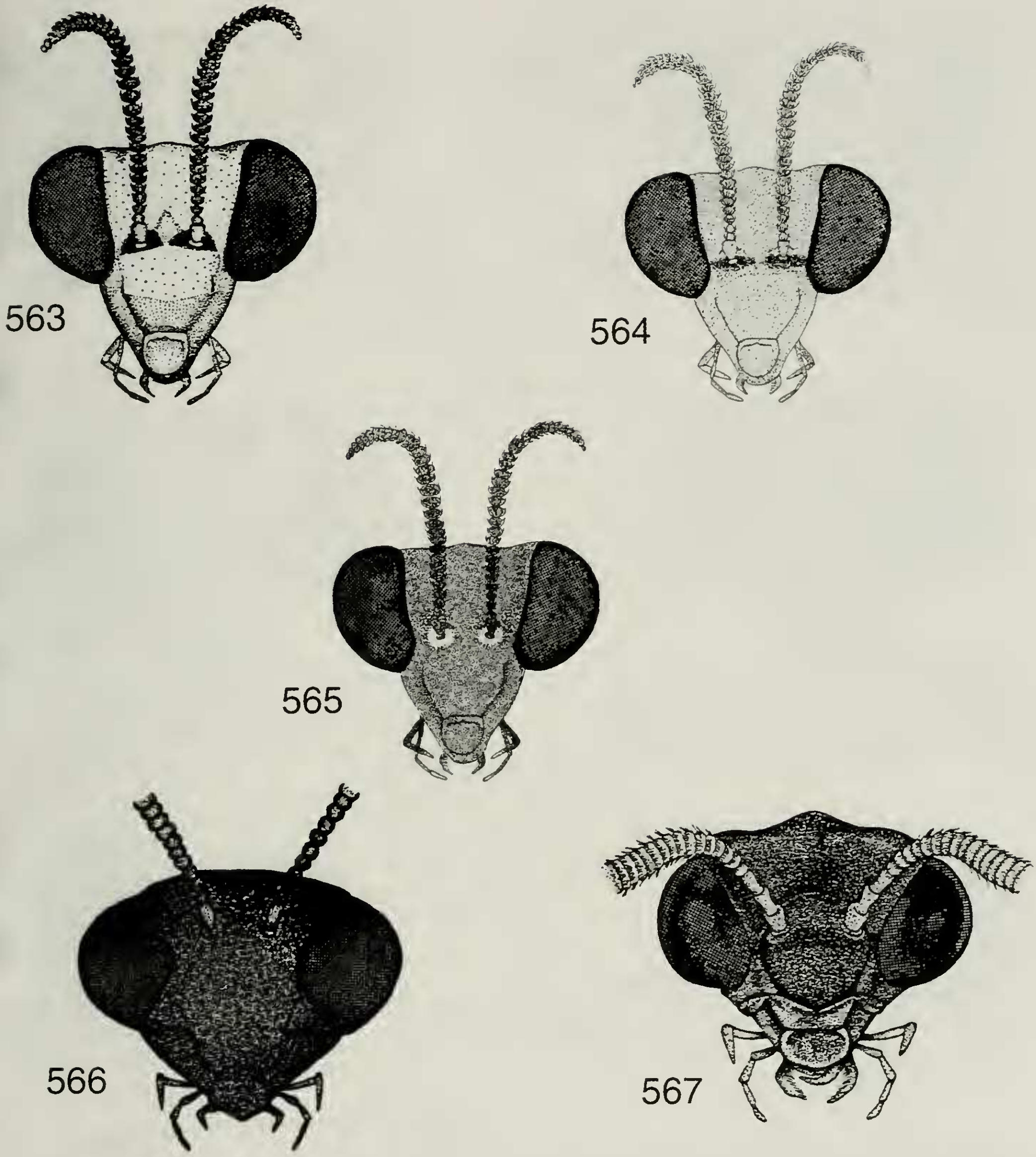
FIGURES 548–552. Head in frontal view. Fig. 548, *Plega hagenella* (Westwood); Fig. 549, *Trichoscelia remipes* (Gerstaecker); Fig. 550, *Nolima infensus* Navás; Fig. 551, *Entanoneura batesella* (Westwood); Fig. 552, *Buyda phthisica* (Gerstaecker). (Illustrations by Fred Ehrman)



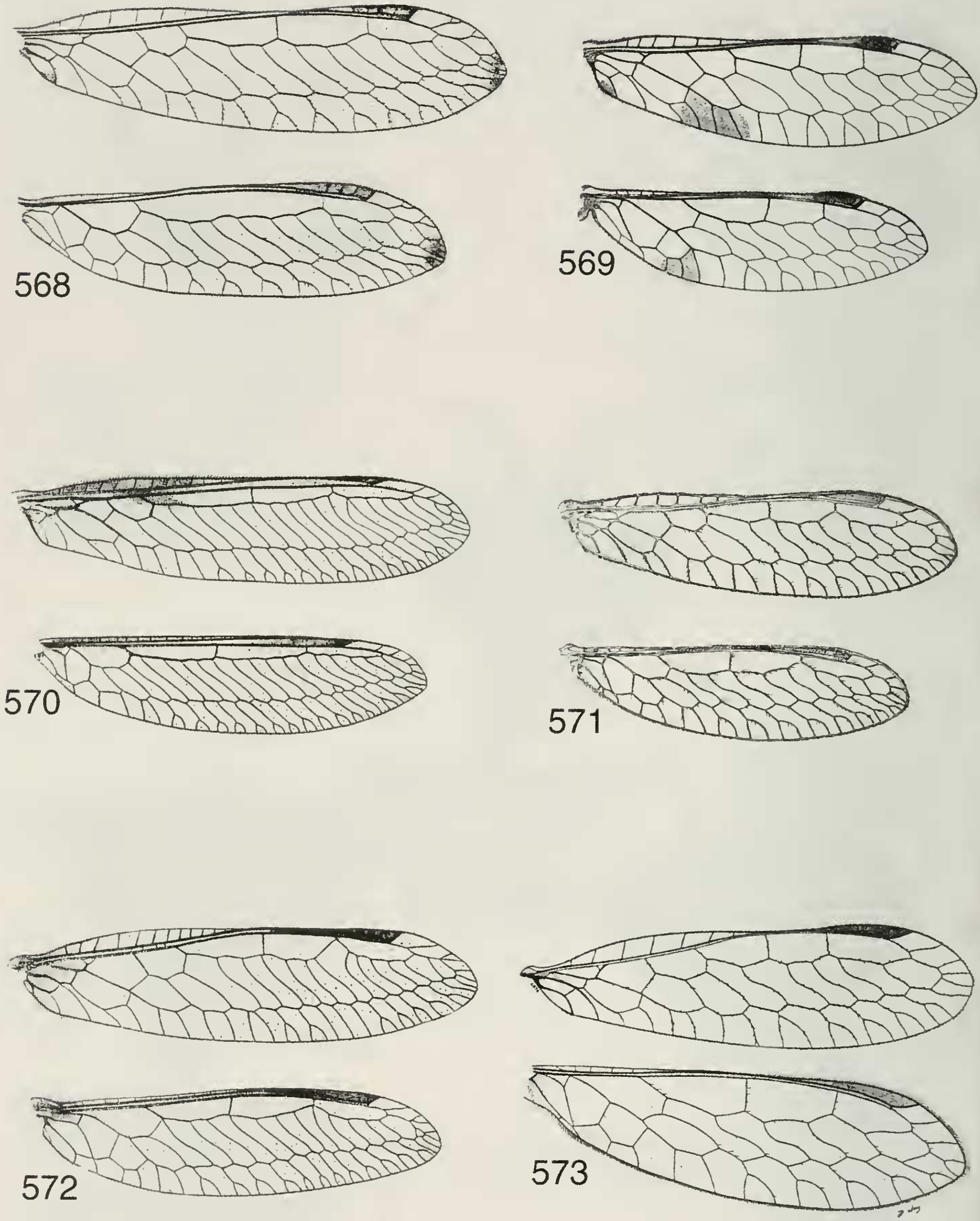
FIGURES 553–557. Head and thorax in dorsal view. Fig. 553, *Plega hagenella* (Westwood); Fig. 554, *Trichoscelia remipes* (Gerstaecker); Fig. 555, *Nolima infensus* Navás; Fig. 556, *Entanoneura batesella* (Westwood); Fig. 557, *Buyda phthisica* (Gerstaecker), head and thorax in dorsal view. (Illustrations by Fred Ehrman)



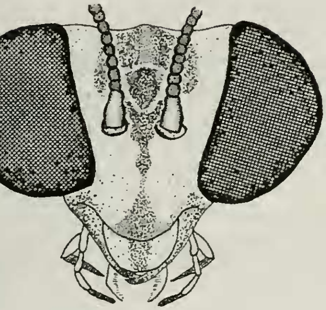
FIGURES 558–562. Head and thorax in dorsal view. Fig. 558, *Climaciella brunnea* (Say)(yellow form); Fig. 559, *Climaciella brunnea* (Say)(red form); Fig. 560, *Climaciella brunnea* (Say)(black form); Fig. 561, *Climaciella obtusa* Hoffman; Fig. 562, *Climaciella porosa* Hoffman. [Illustrations by Fred Ehrman (558), Victoria Saxe (559–561) and Virginia Kirsch (562)]



FIGURES 563–567. Head in frontal view. Fig. 563, *Climaciella brunnea* (Say)(yellow form); Fig. 564, *Climaciella brunnea* (Say)(red form); Fig. 565, *Climaciella brunnea* (Say)(black form); Fig. 566, *Climaciella obtusa* Hoffman; Fig. 567, *Climaciella porosa* Hoffman. [Illustrations by Fred Ehrman (563, 566), Victoria Saxe (564, 565) and Virginia Kirsch (567)]



FIGURES 568–573. Right fore- and hind wings. Fig. 568, *Buyda phthisica* (Gerstaecker); Fig. 569, *Haematomantispa nubeculosa* (Navás); Fig. 570, *Entanoneura batesella* (Westwood); Fig. 571, *Dicromantispa sayi* (Banks); Fig. 572, *Dicromantispa gracilis* (Erichson); Fig. 573, *Dicromantispa synapsis* Hoffman. [Illustrations by Fred Ehrman (568, 570–572), Virginia Kirsch (569), Diane Wong (573, in part) and Linda Seabrooks Campbell (573, in part)]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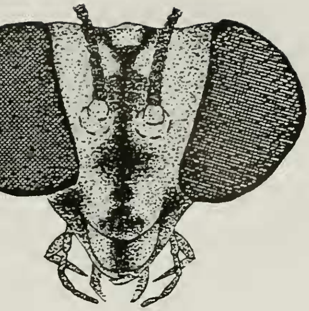
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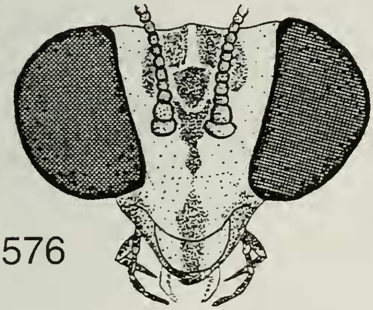
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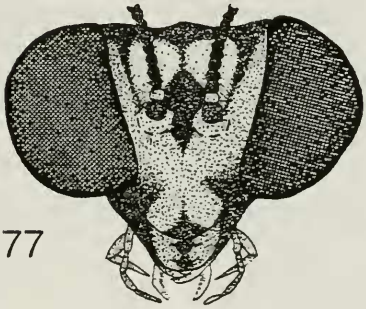
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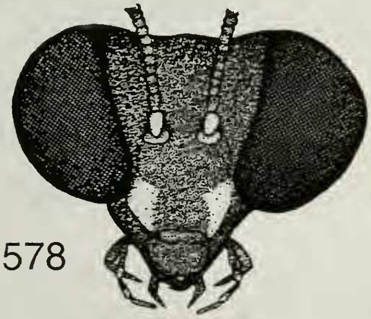
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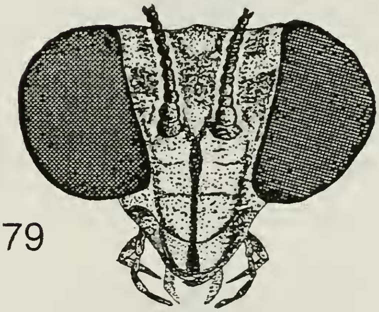
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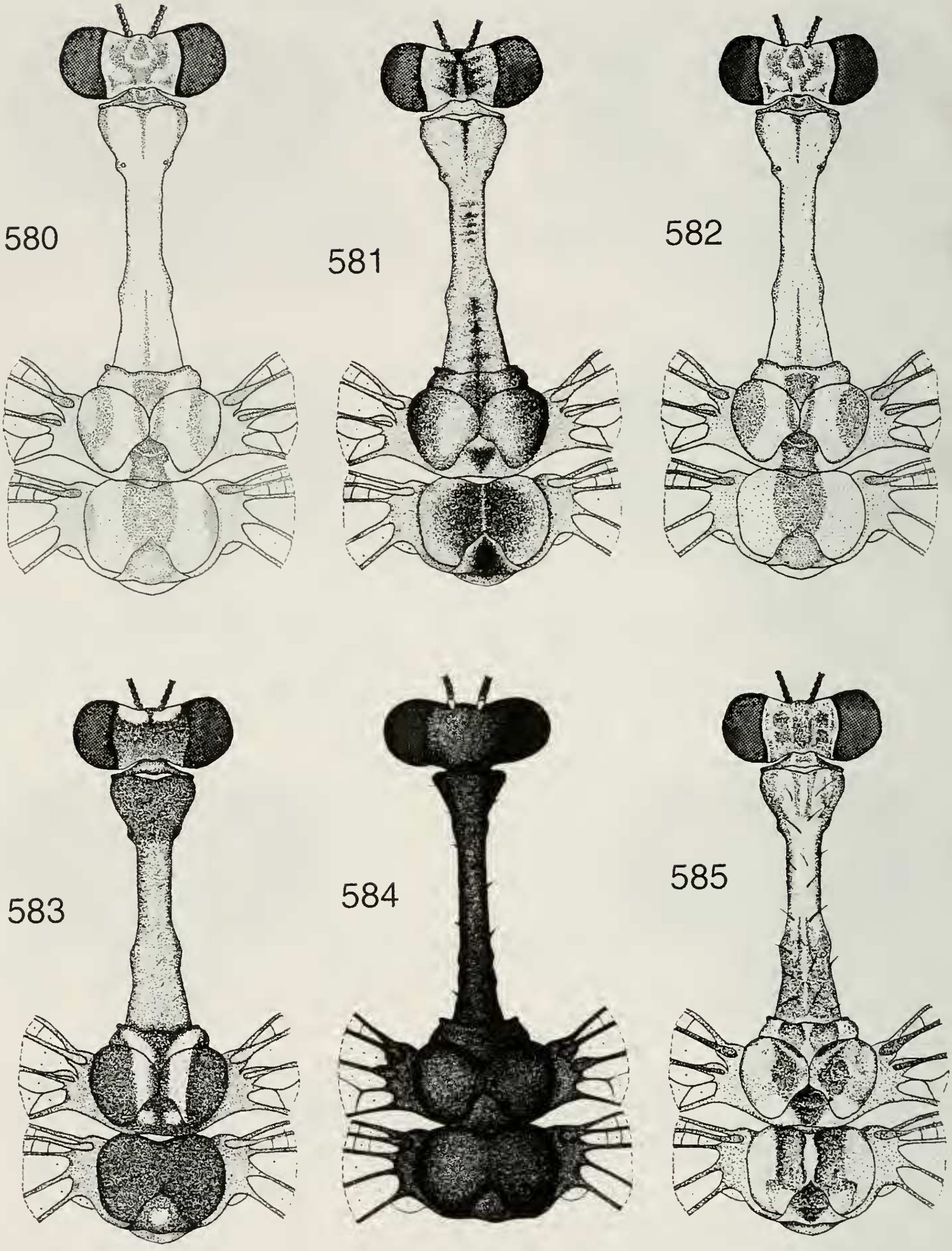
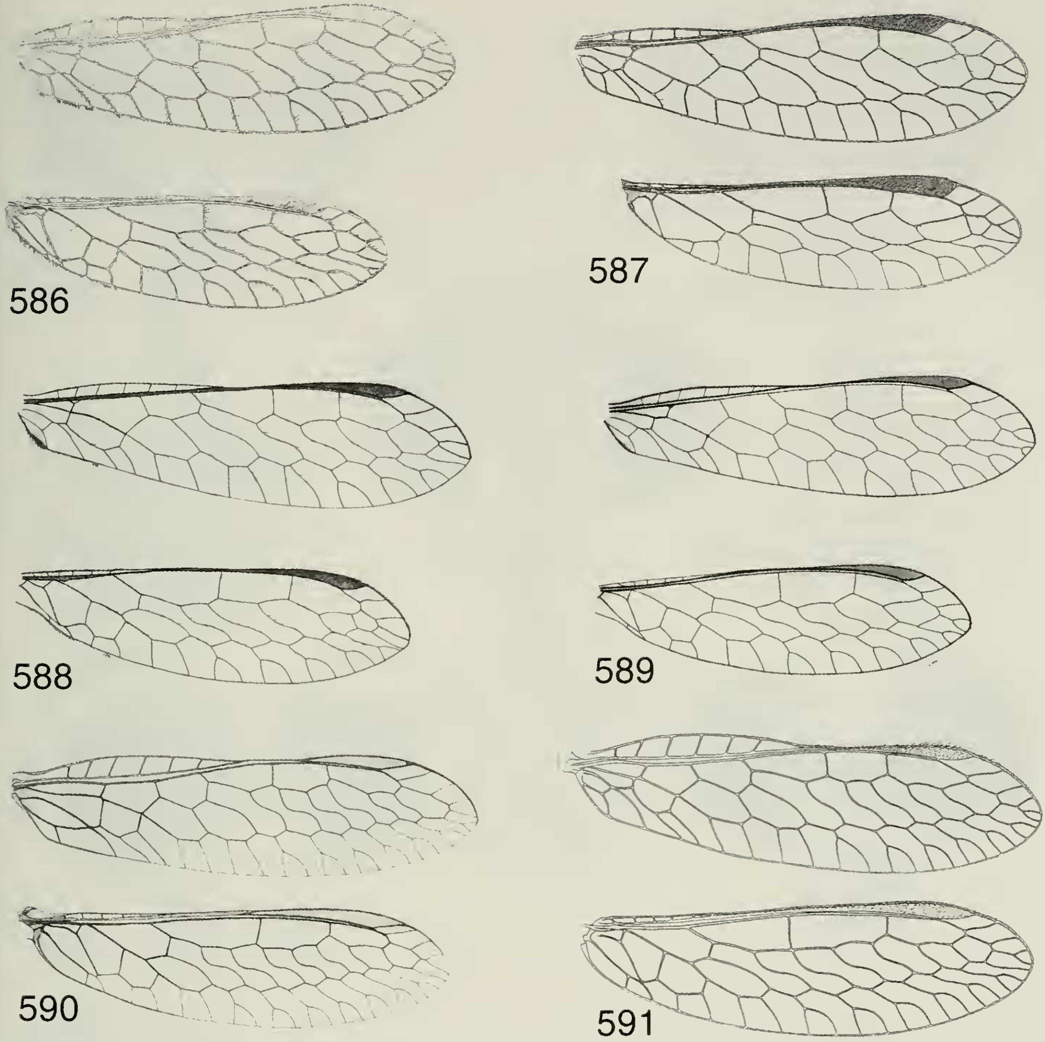
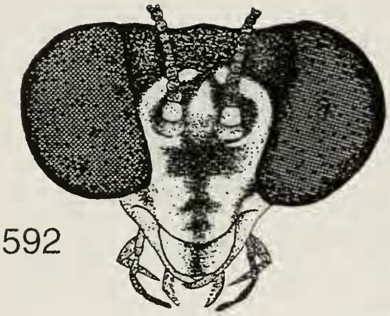
FIGURES 574–579. Head in frontal view. Fig. 574, *Dicromantispa debilis* (Gerstaecker); Fig. 575, *Dicromantispa gracilis* (Erichson); Fig. 576, *Dicromantispa sayi* (Banks); Fig. 577, *Dicromantispa synapsis* Hoffman; Fig. 578, *Haematomantispa nubeculosa* (Navás); Fig. 579, *Leptomantispa pulchella* (Banks). [Illustrations by Victoria Saxe (575, 576, 579), Norman Penny (574), and Fred Ehrman (577, 578)



FIGURES 580–585. Head and thorax in dorsal view. Fig. 580, *Dicromantispa debilis* (Gerstaecker); Fig. 581, *Dicromantispa gracilis* (Erichson); Fig. 582, *Dicromantispa sayi* (Banks); Fig. 583, *Dicromantispa synapsis* Hoffman; Fig. 584, *Haematomantispa nubeculosa* (Navás); Fig. 585, *Leptomantispa pulchella* (Banks). [Illustrations by Victoria Saxe (581, 582, 585), Norman Penny (580), and Fred Ehrman (583, 584)]



FIGURES 586–591. Right fore- and hind wings. Fig. 586, *Leptomantispa pulchella* (Banks); Fig. 587, *Leptomantispa chaos* Hoffman; Fig. 588, *Leptomantispa nymphe* Hoffman; Fig. 589, *Zeugomantispa compellens* (Walker); Fig. 590, *Zeugomantispa minuta* (Fabricius); Fig. 591, *Zeugomantispa viridula* (Erichson). [Illustrations by Fred Ehrman (586), Virginia Kirsch (587, 591), Linda Seabrooks Campbell (588), Diane Wong (589) and Jere Schweikert (590)]



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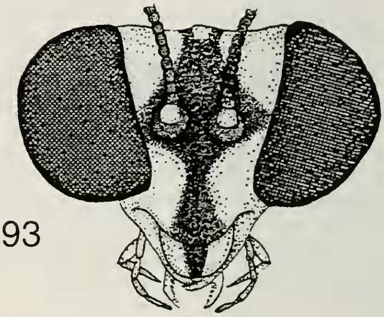

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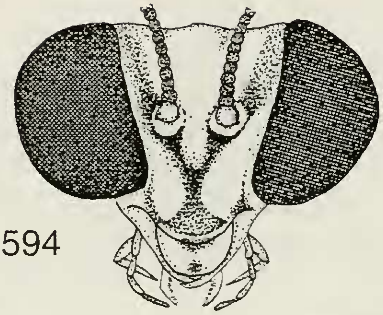

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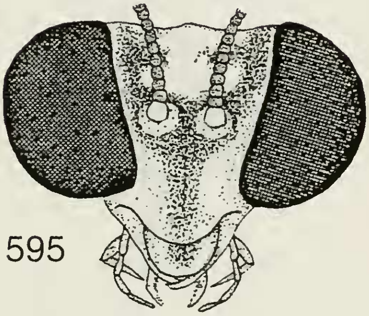

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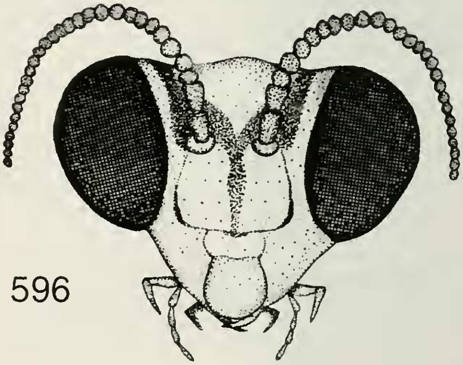

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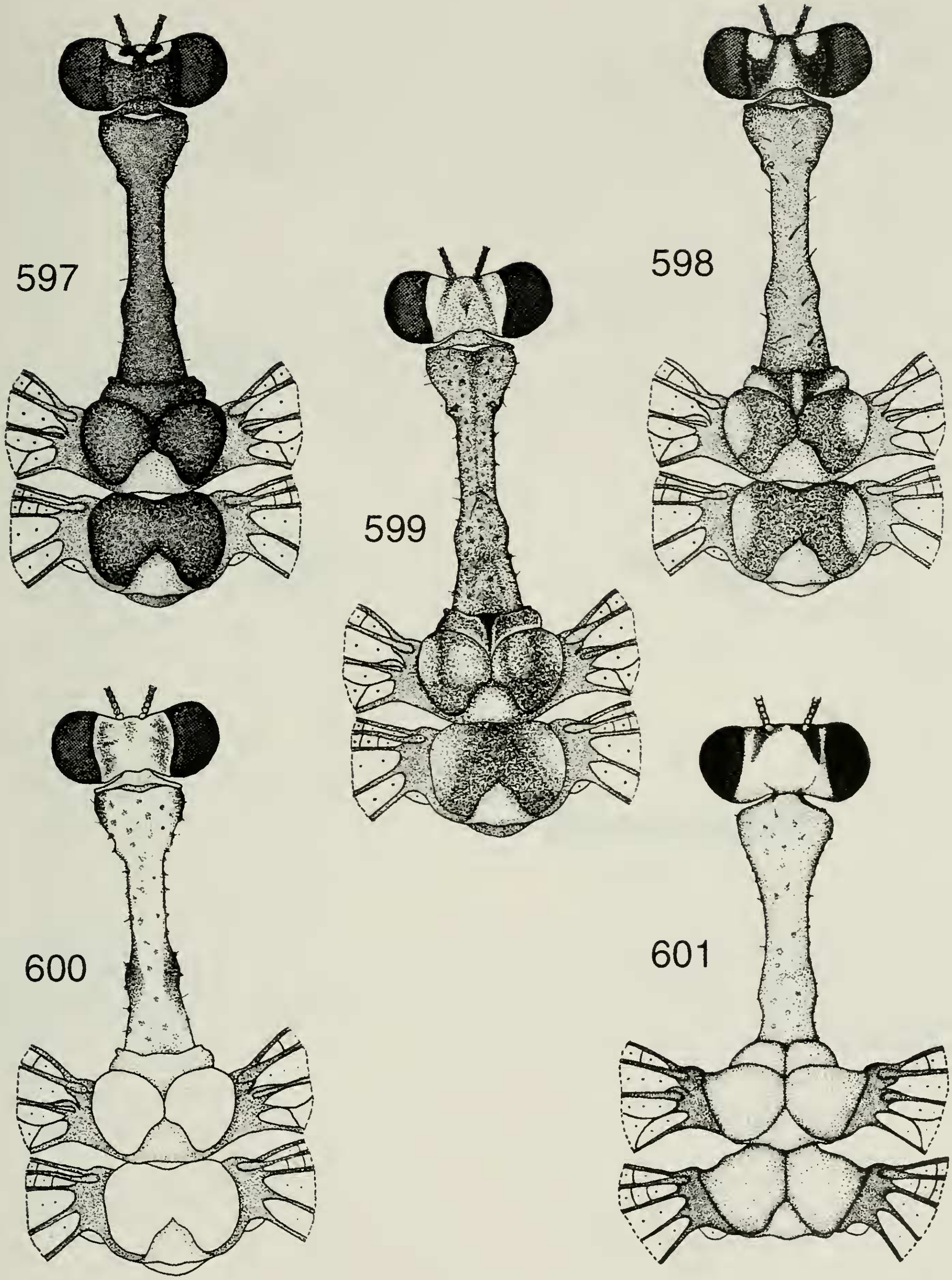
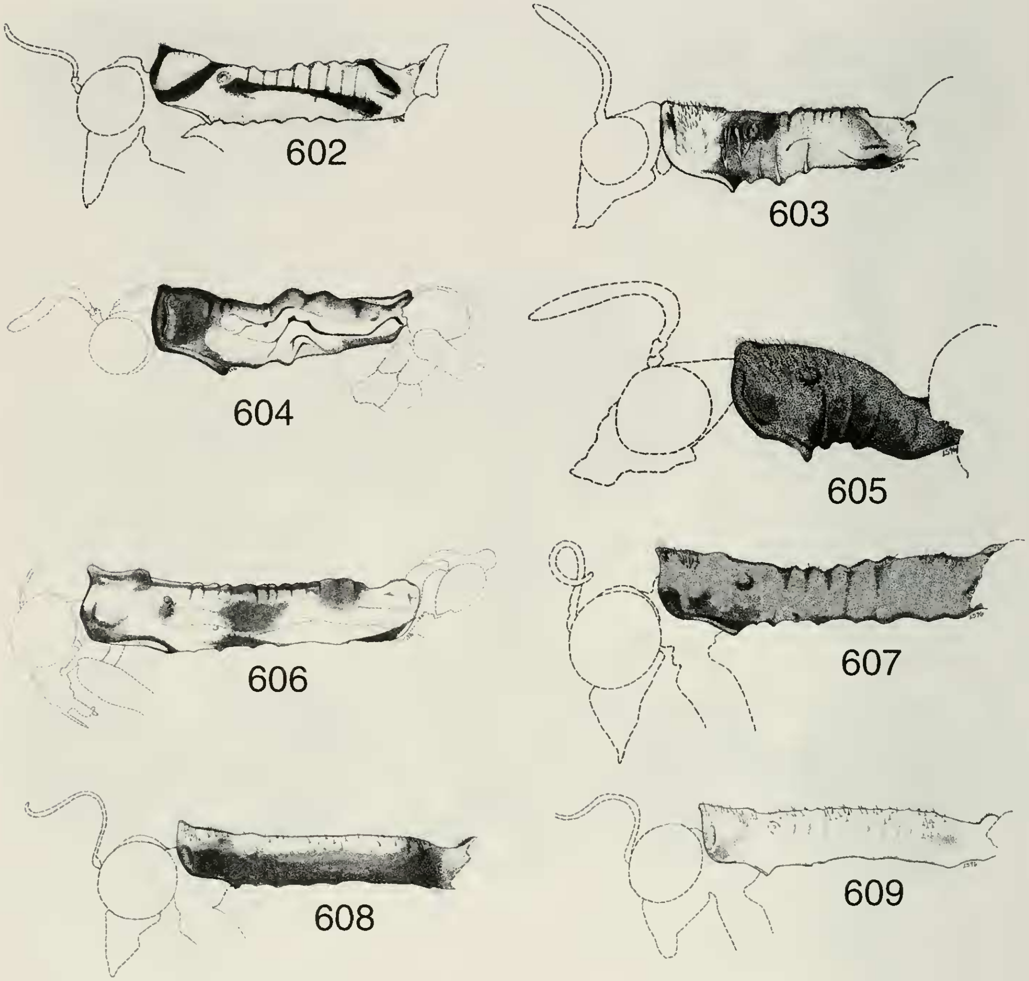
FIGURES 592–596. Head in frontal view. Fig. 592, *Leptomantispa chaos* Hoffman; Fig. 593, *Leptomantispa nymphe* Hoffman; Fig. 594, *Zeugomantispa compellens* (Walker); Fig. 595, *Zeugomantispa minuta* (Fabricius); Fig. 596, *Zeugomantispa viridula* (Erichson). [Illustrations by Victoria Saxe (592–595) and Fred Ehrman (596)]



FIGURES 597–601. Head and thorax in dorsal view. Fig. 597, *Leptomantispa chaos* Hoffman; Fig. 598, *Leptomantispa nymphe* Hoffman; Fig. 599, *Zeugomantispa compellens* (Walker); Fig. 600, *Zeugomantispa minuta* (Fabricius); Fig. 601, *Zeugomantispa viridula* (Erichson). [Illustrations by Victoria Saxe (597–600) and Fred Ehrman (601)]



FIGURES 602–609. Pronotum in lateral view. Fig. 602, *Entanoneura batesella* (Westwood); Fig. 603, *Climaciella brunnea* (Say)(yellow form); Fig, 604, *Climaciella porosa* Hoffman; Fig. 605, *Climaciella obtusa* Hoffman; Fig. 606, *Buyda phthisica* (Gerstaecker); Fig. 607, *Dicromantispa sayi* (Banks); Fig. 608, *Leptomantispa pulchella* (Banks); Fig. 609, *Zeugomantispa minuta* (Fabricius). (Illustrations by Linda Seabrooks Campbell)

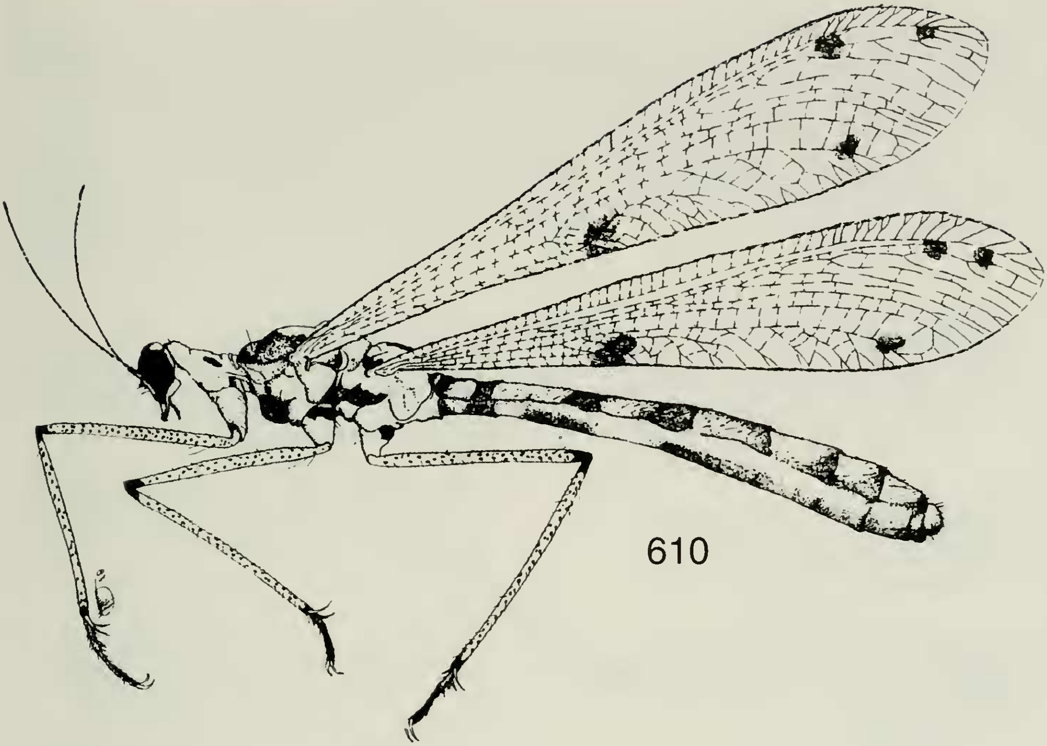
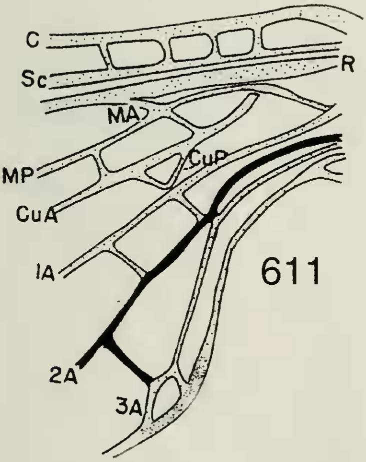
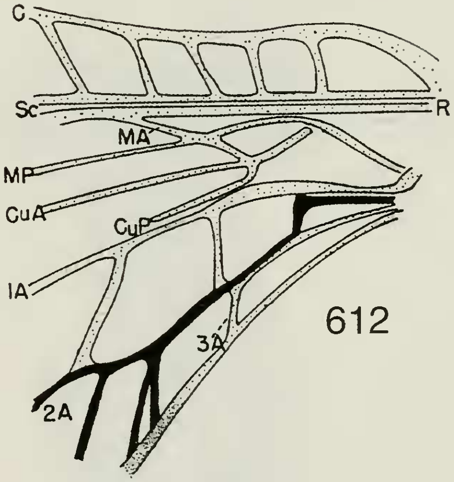
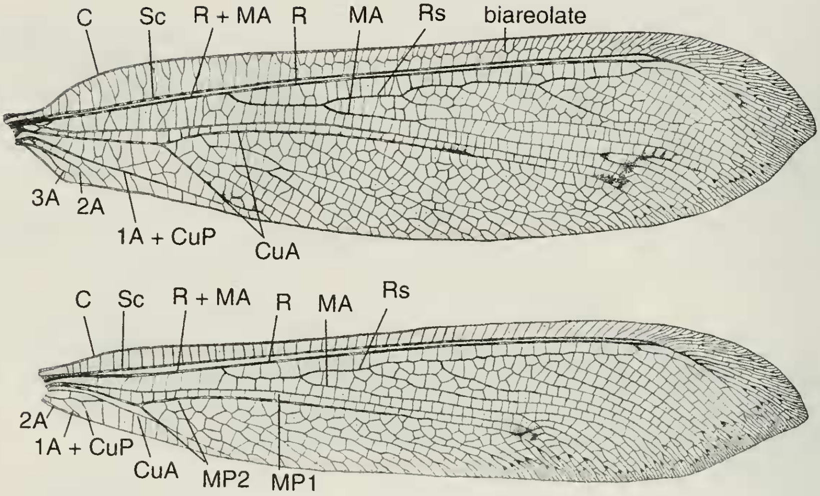


FIGURE 610. *Elachyleon punctipennis*, habitus view. (Illustration by Artêmio Coelho da Silva)





FIGURES 611–612. Base of left forewing. Fig. 611, *Dejuna* sp.; Fig. 612, *Myrmeleon* sp. (Illustrations from Stange, 1970a)



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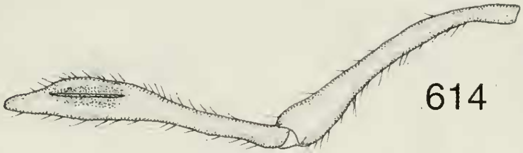

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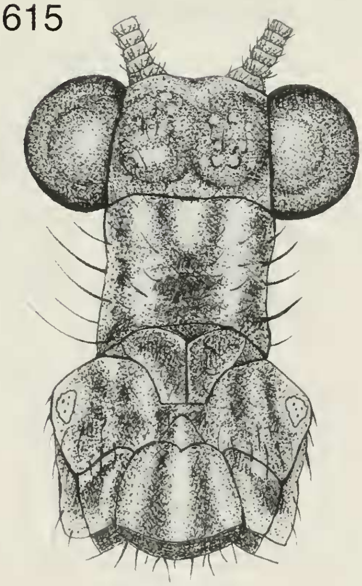

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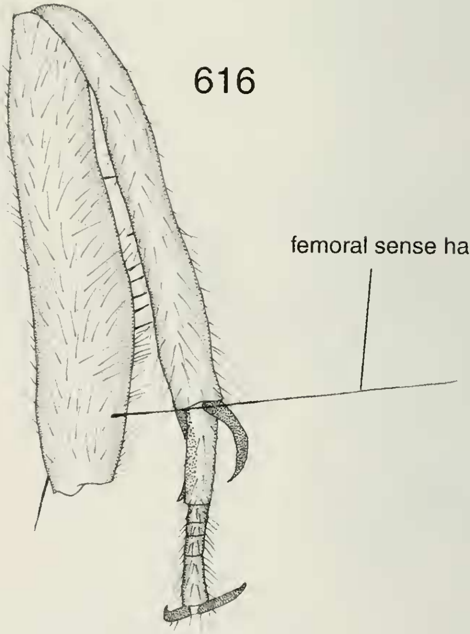
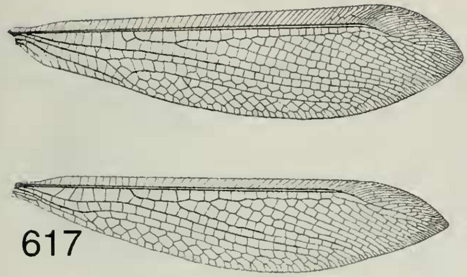


FIGURES 613–616. *Vella fallax* (Rambur). Fig. 613, right fore- and hind wings; Fig. 614, labial palp in lateral view; Fig. 615, head and thorax in dorsal view; Fig. 616, hind leg in lateral view. [Illustrations by Fred Ehrman (613), Norman Penny (614, 616), and Victoria Saxe (615)]



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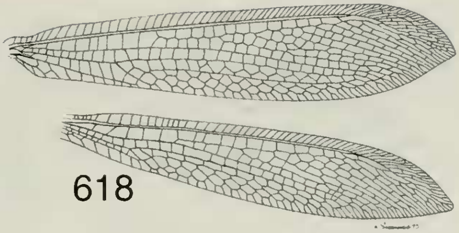

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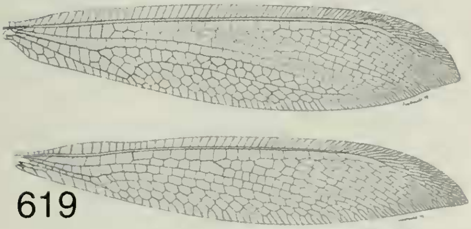

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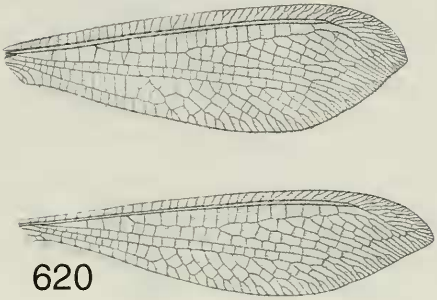

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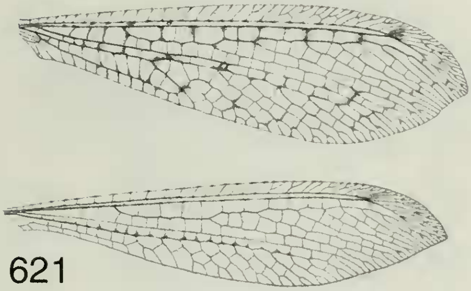

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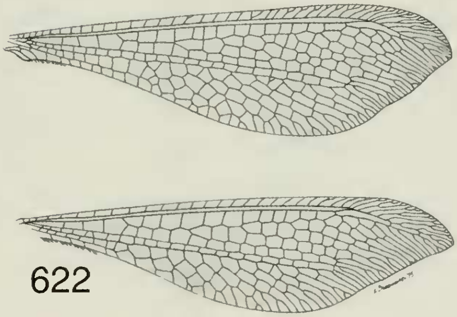

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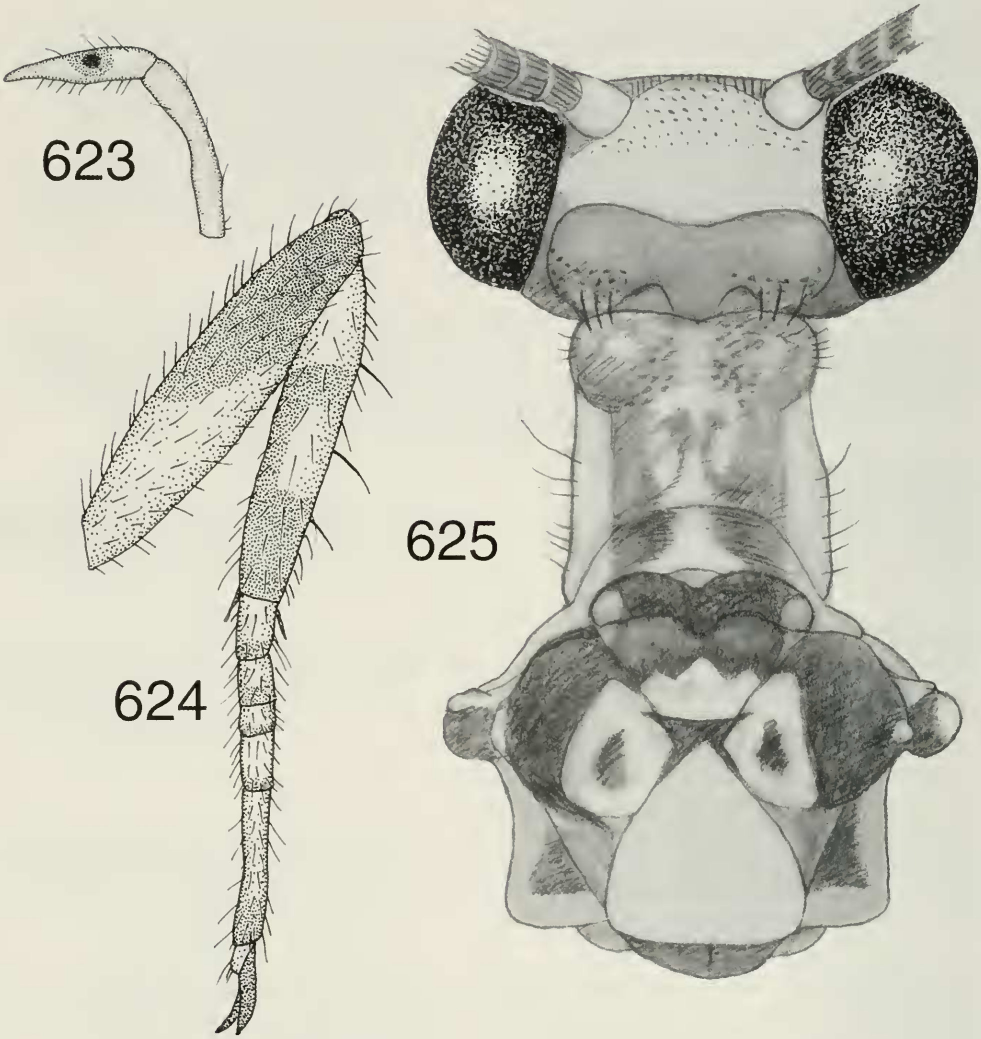
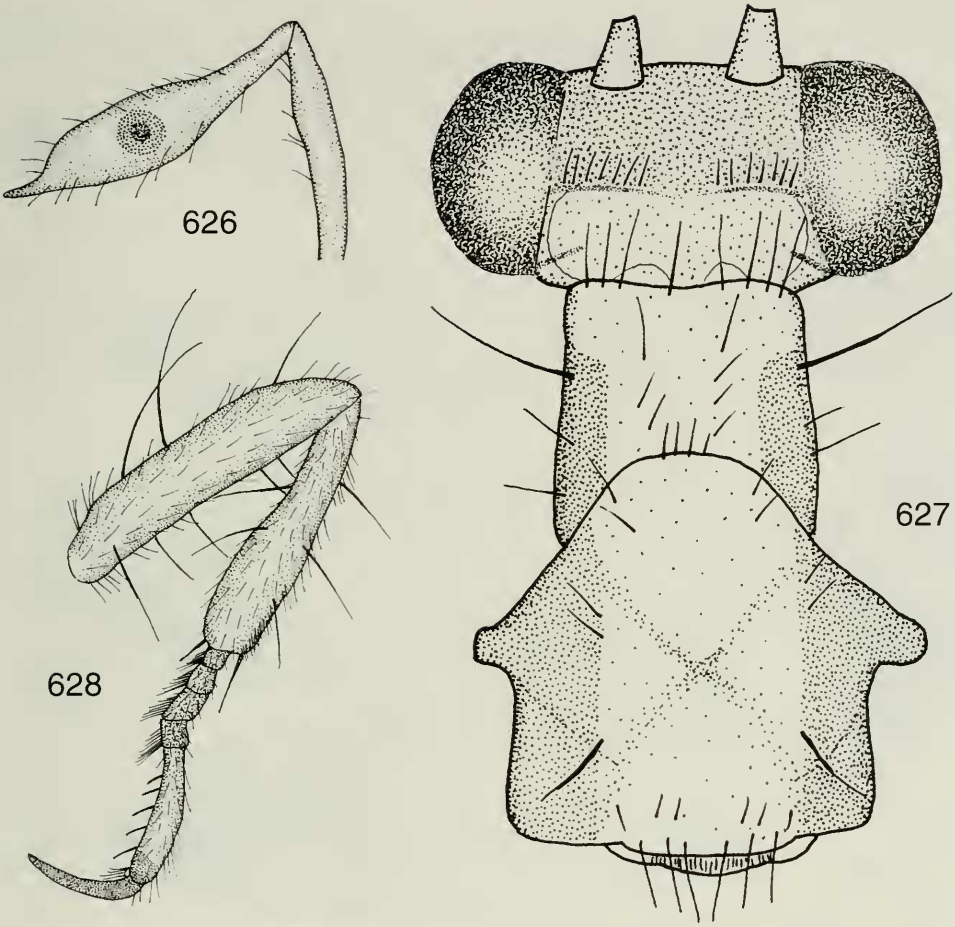
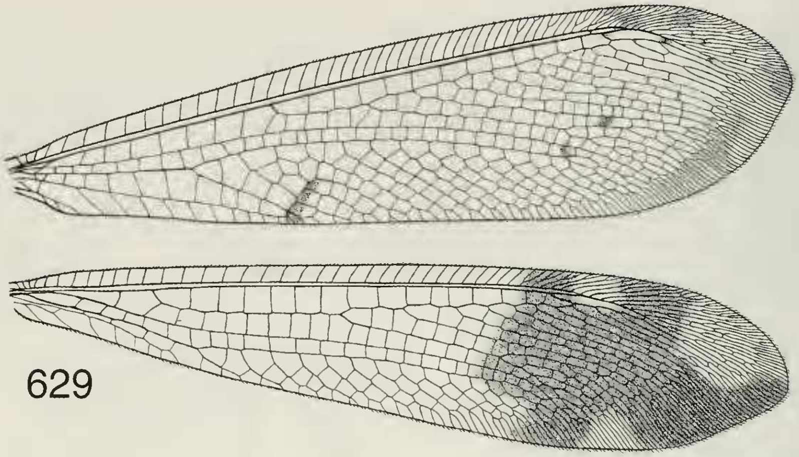
FIGURES 617–622. Right fore- and hind wings. Fig. 617, *Myrmeleon perspicuus* Gerstaecker; Fig. 618, *Myrmeleon timidus* Gerstaecker; Fig. 619, *Myrmeleon uniformis* Navás; Fig. 620, *Dejuna fenestrata* (Banks); Fig. 621, *Dejuna mimica* (Stange); Fig. 622, *Dejuna setosa* (Stange). [Illustrations by Linda Seabrooks Campbell (617, 618, 622) and Fred Ehrman (619–621)]



FIGURES 623–625. *Dejuna mimica* (Stange). Fig. 623, female labial palp in lateral view; Fig. 624, foreleg in lateral view; Fig. 625, head and thorax in dorsal view. [Illustrations by Norman Penny (623, 624) and Dahlia Herrera (625)]



FIGURES 626–628. *Dejuna setosa* (Stange). Fig. 626, female labial palp in lateral view; Fig. 627, head and thorax in dorsal view; Fig. 628, foreleg in lateral view. [Illustrations by Norman Penny (626–628)]



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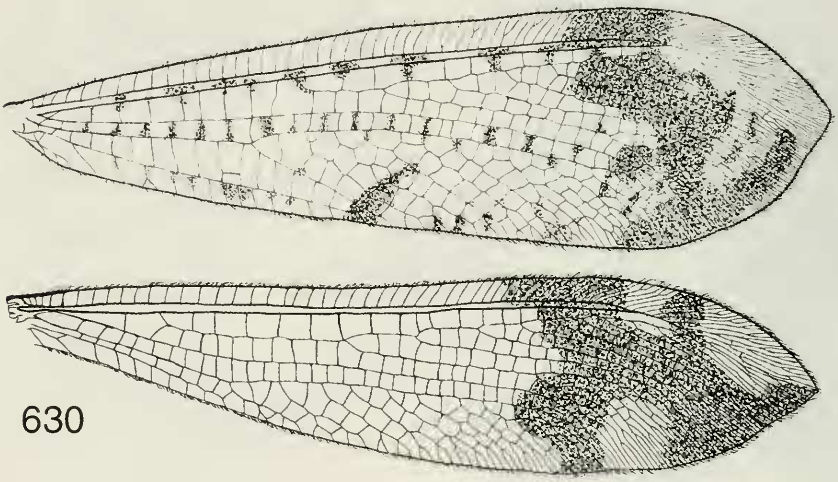

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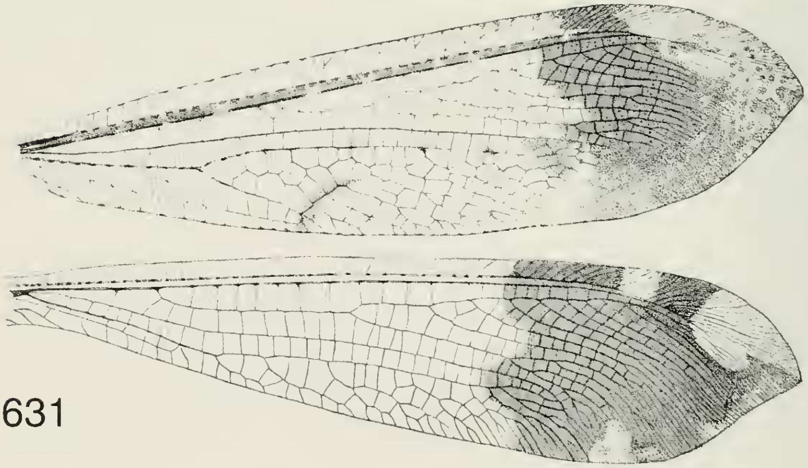

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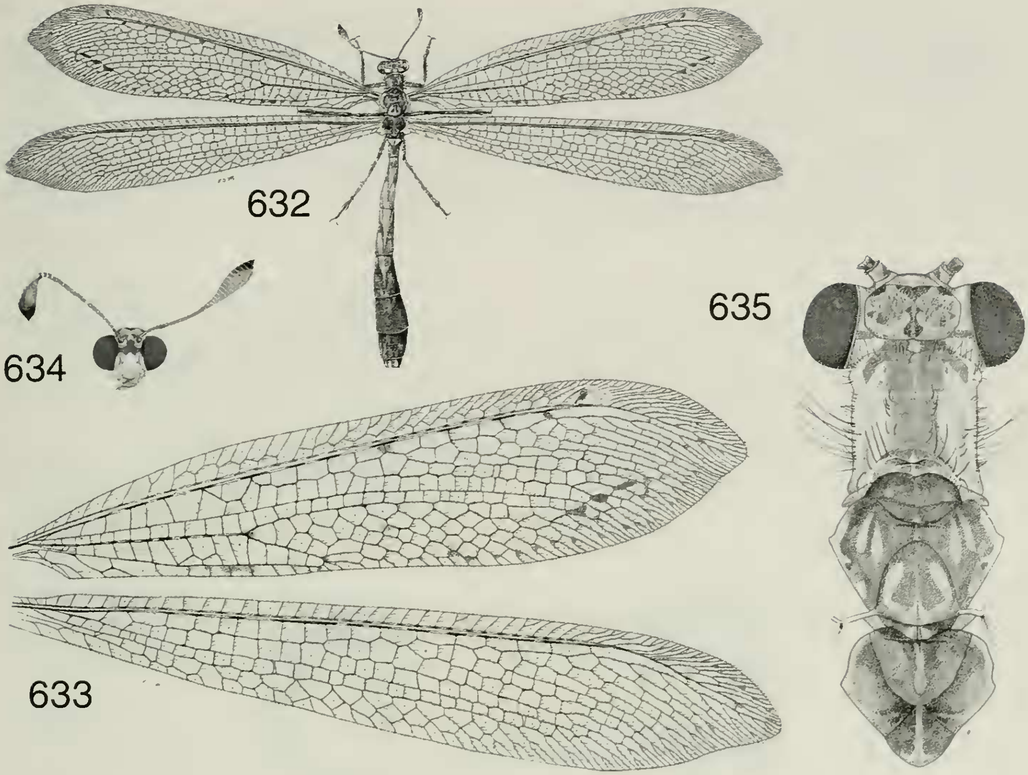
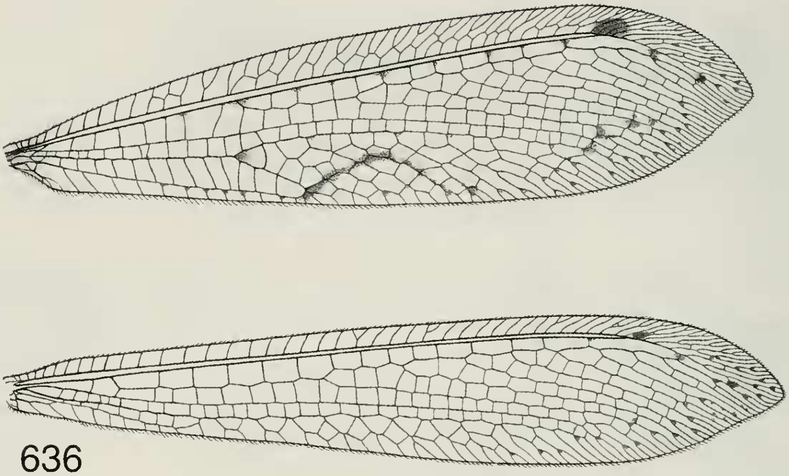
FIGURES 629–631. Right fore- and hind wings. Fig. 629, *Glenurus heteropteryx* Gerstaecker; Fig. 630, *Glenurus luniger* (Gerstaecker); Fig. 631, *Glenurus proi* Navás. [Illustrations by Fred Ehrman (629), Jeanine Myer (630) and Virginia Kirsch (631)]



FIGURES 632–635. *Eremoleon dunklei* Stange. Fig. 632, habitus view; Fig. 633, right fore- and hind wings; Fig. 634, head in frontal view; Fig. 635, head and thorax in dorsal view. (Illustrations by Zina Deretsky)



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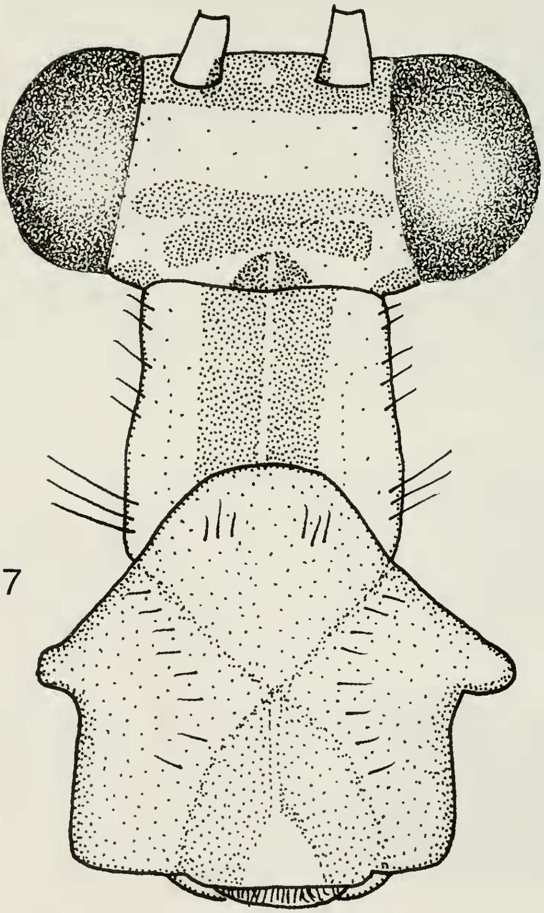

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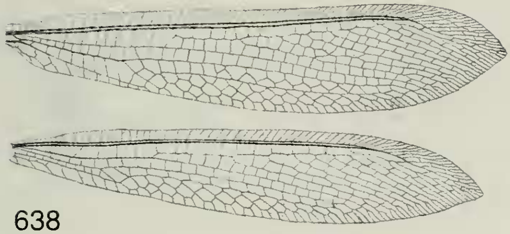
FIGURES 636–637. *Eremoleon genini* (Navás). Fig. 636, right fore- and hind wings; Fig. 637, head and thorax in dorsal view. [Illustrations by Virginia Kirsch (636) and Norman Penny (637)]



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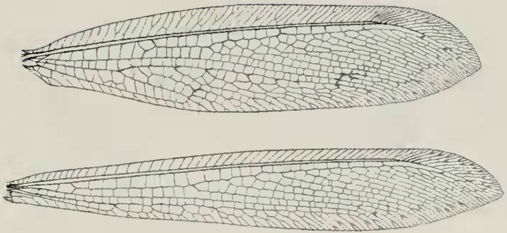

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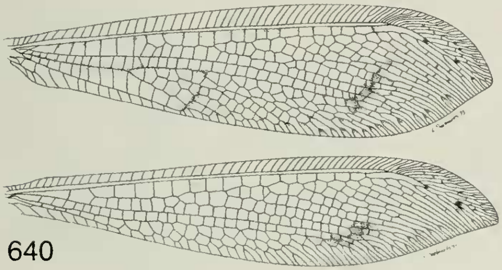

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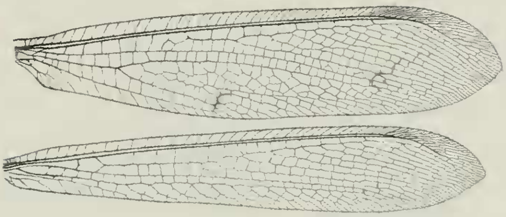

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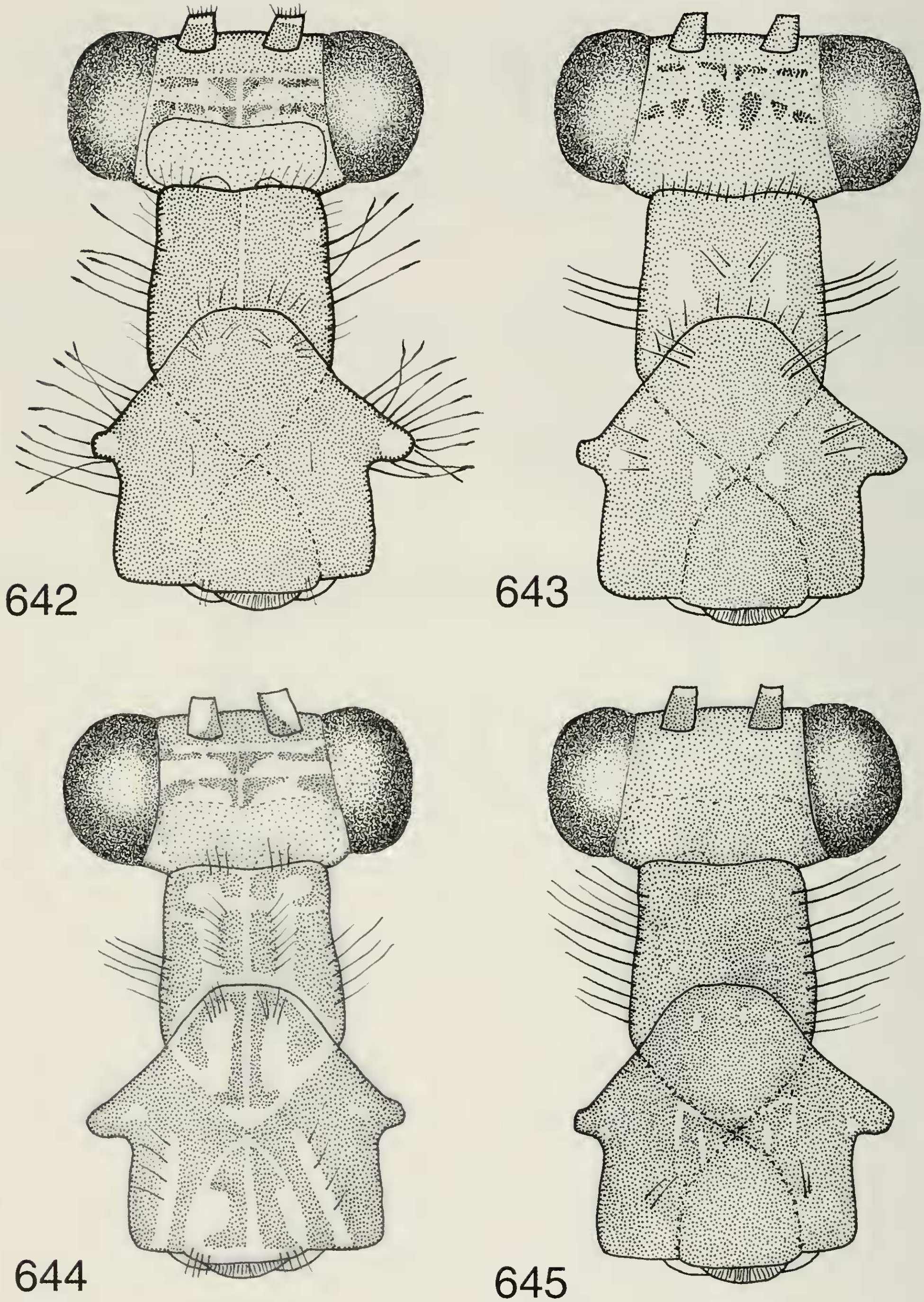
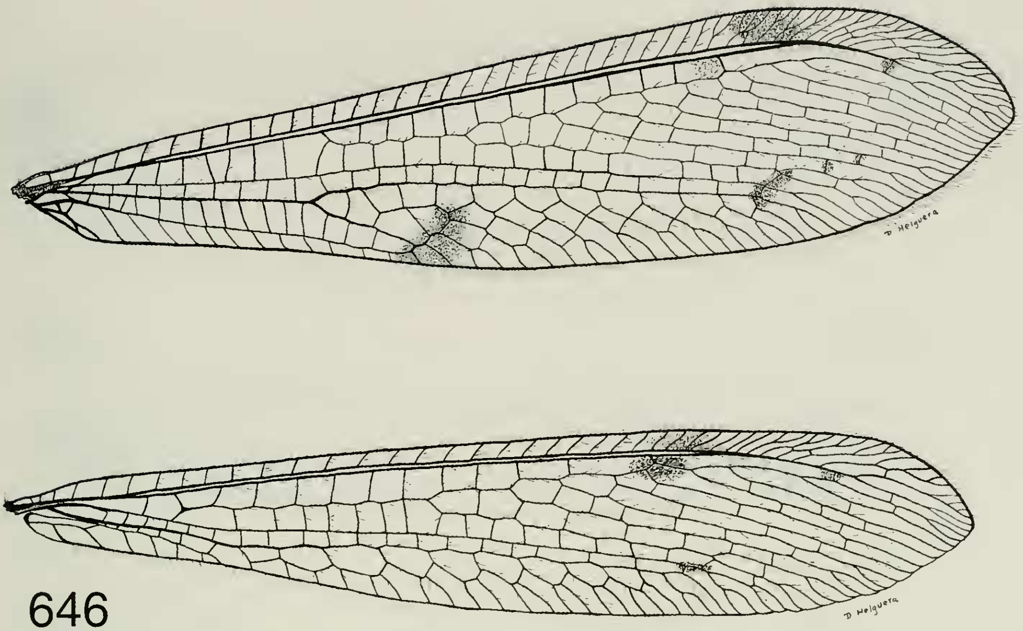
FIGURES 638–641. Right fore- and hind wings. Fig. 638, *Purenleon abruptus*, Stange, new species; Fig. 639, *Purenleon debilis* (Gerstaecker); Fig. 640, *Purenleon iniquus* (Navás); Fig. 641, *Purenleon parallelus* (Navás). [Illustrations by Virginia Kirsch (639, 641), Linda Seabrooks Campbell (640) and Fred Ehrman (638)]



FIGURES 642–645. Head and thorax in dorsal view. Fig. 642, *Purenleon abruptus,* Stange, new species; Fig. 643, *Purenleon debilis* (Gerstaecker); Fig. 644, *Purenleon iniquus* (Navás); Fig. 645, *Purenleon parallelus* (Banks). (Illustrations by Norman Penny)



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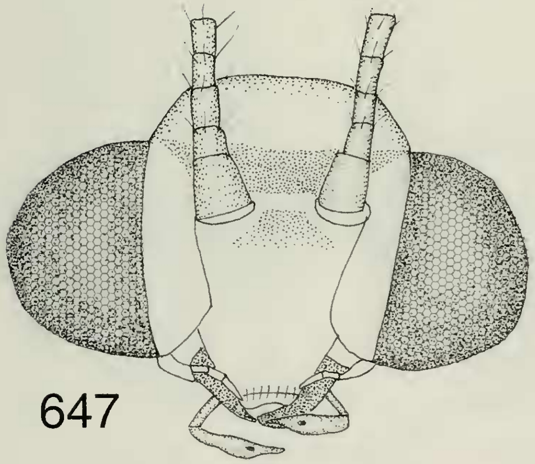

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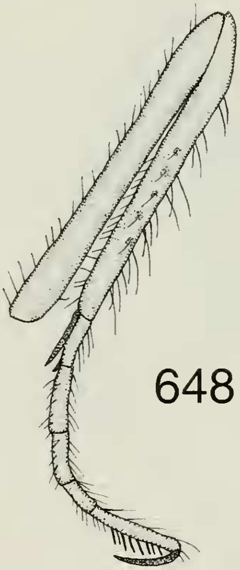

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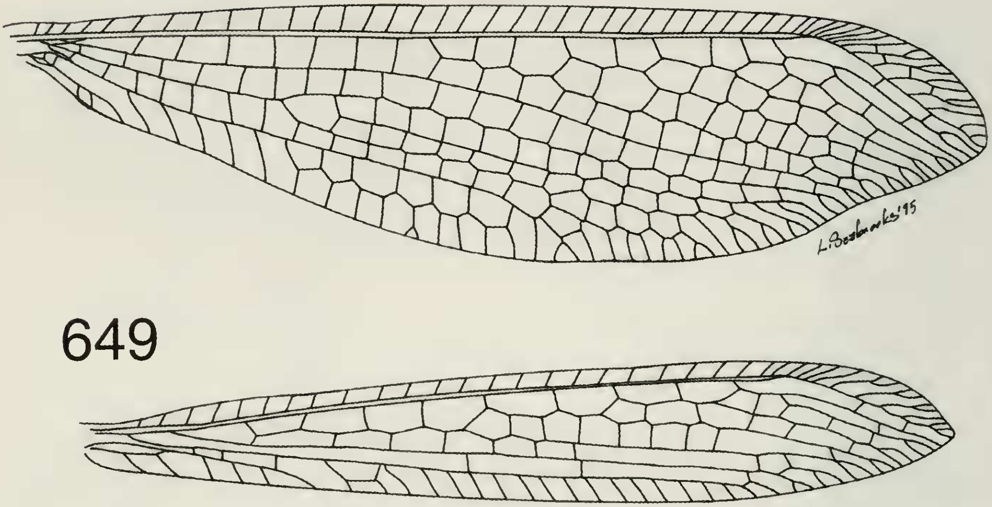
FIGURES 646–648. *Elachyleon punctipennis* Esben-Petersen. Fig. 646, right fore- and hind wings; Fig. 647, head in frontal view; Fig. 648, apex of foreleg in lateral view. [Illustrations by Norman Penny (647, 648) and Dahlia Helguera (646)]



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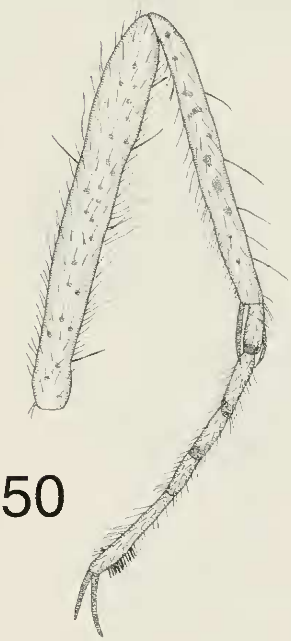

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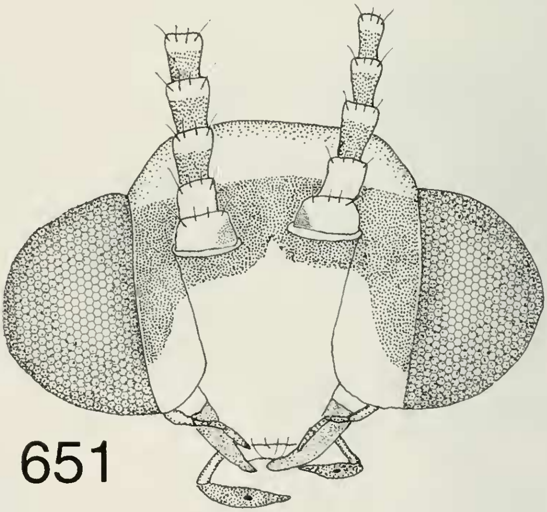

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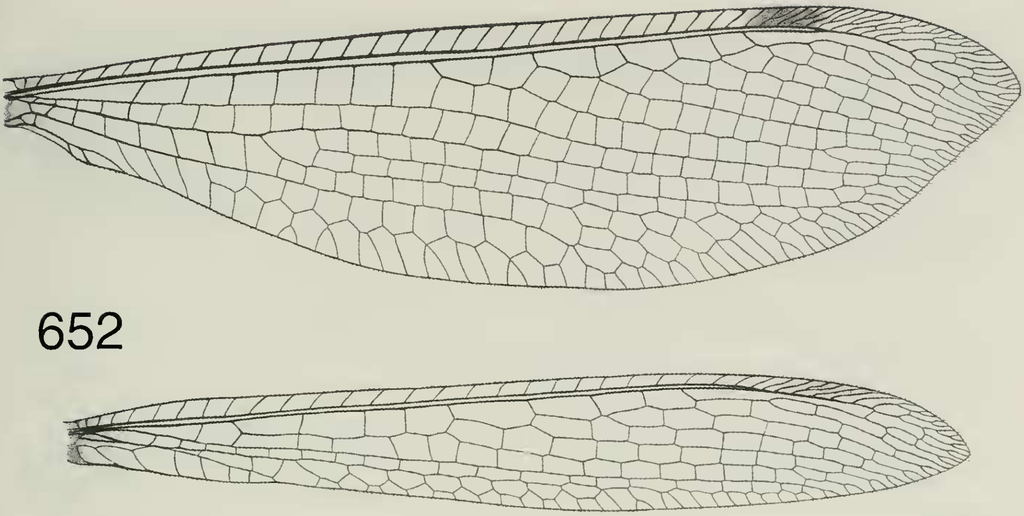
FIGURES 649–651. *Dimarella angusta* (Banks). Fig. 649, right fore- and hind wings; Fig. 650, forefemur in lateral view; Fig. 651, head in frontal view. [Illustration by Linda Seabrooks Campbell(649) and Norman Penny (650, 651)]



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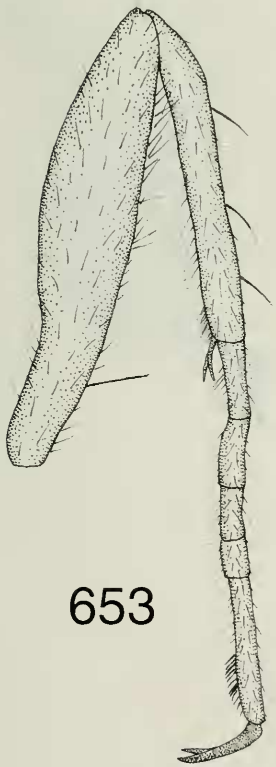

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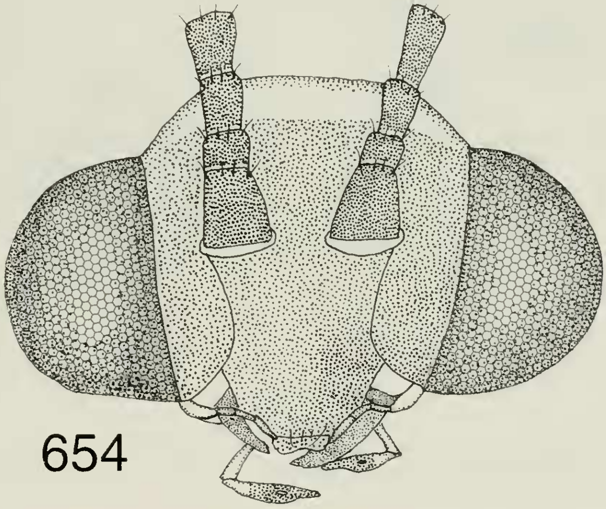

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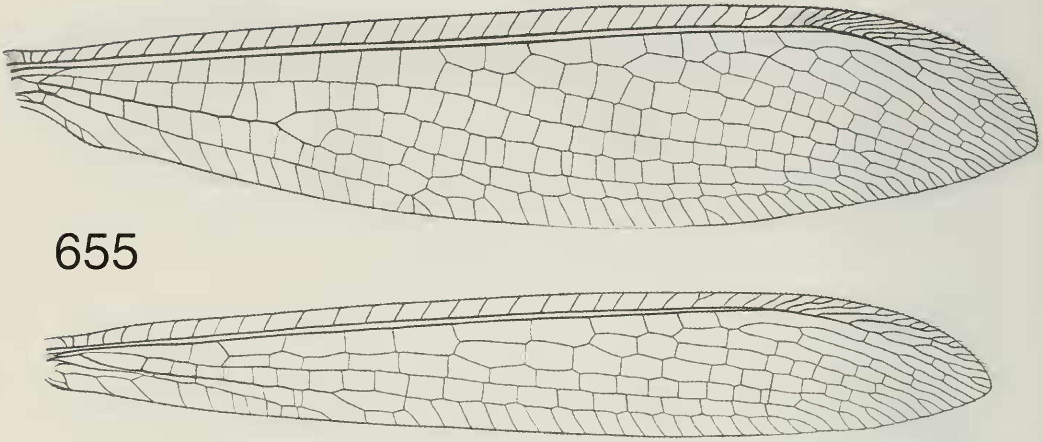
FIGURES 652–654. *Dimarella garciai* (Navás). Fig. 652, right fore- and hind wings; Fig. 653, forefemur in lateral view; Fig. 654, head in frontal view. [Illustrations by Virginia Kirsch (652) and Norman Penny (653, 654)]



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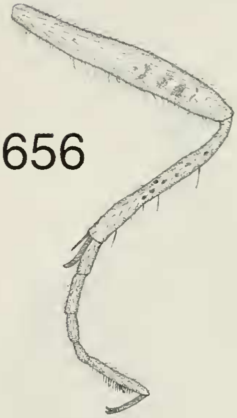

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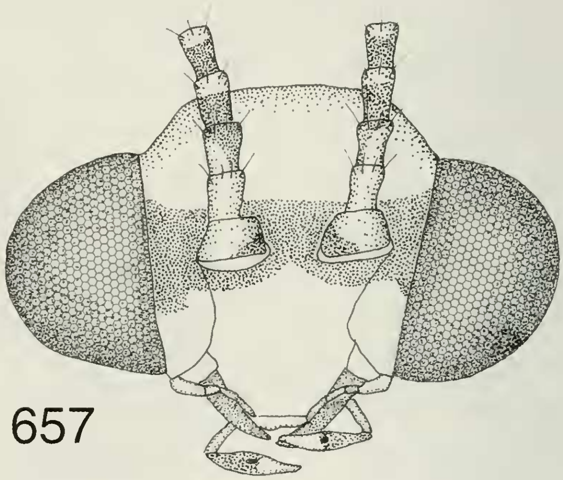

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FIGURES 655–657. *Dimarella mixteca* Miller. Fig. 655, right fore- and hind wings; Fig. 656, forefemur in lateral view; Fig. 657, head in frontal view. [Illustrations by Virginia Kirsch (655) and Norman Penny (656, 657)]

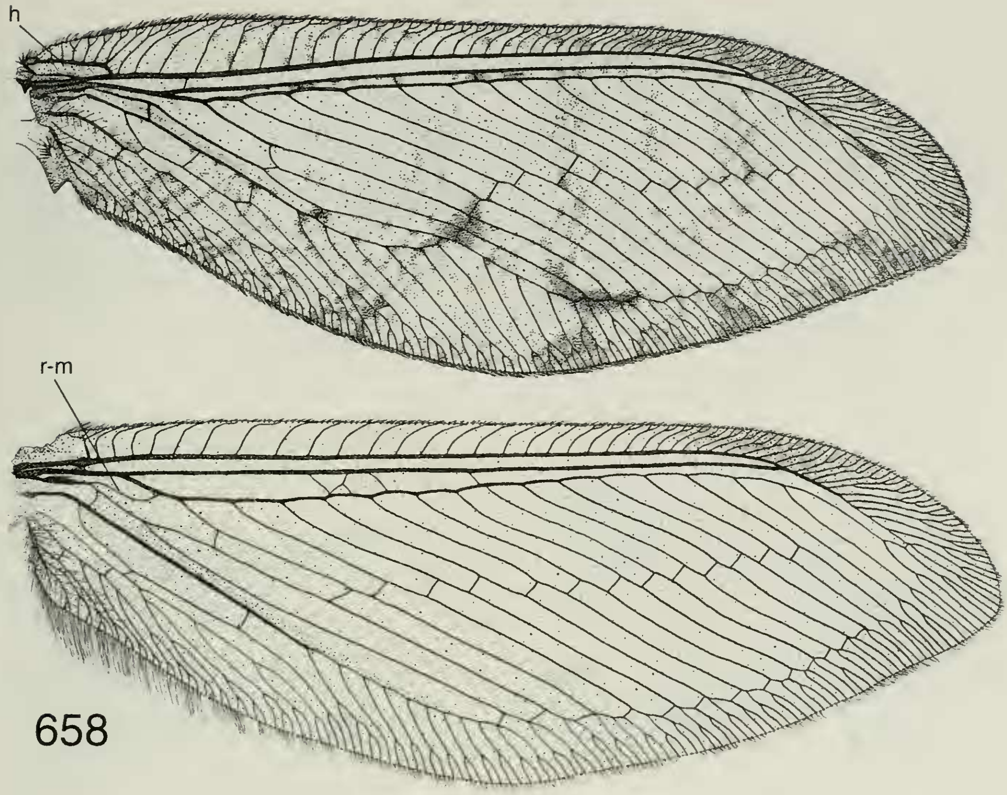

FIGURE 658. *Polystoechotes punctatus* (Fabricius), right fore- and hind wings. (Illustration by Jere Schweikert)

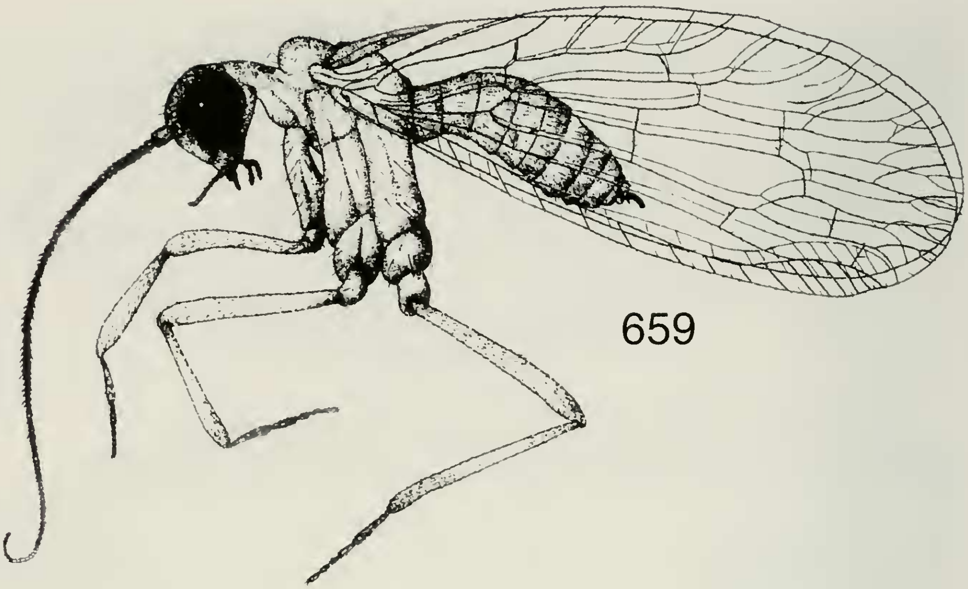

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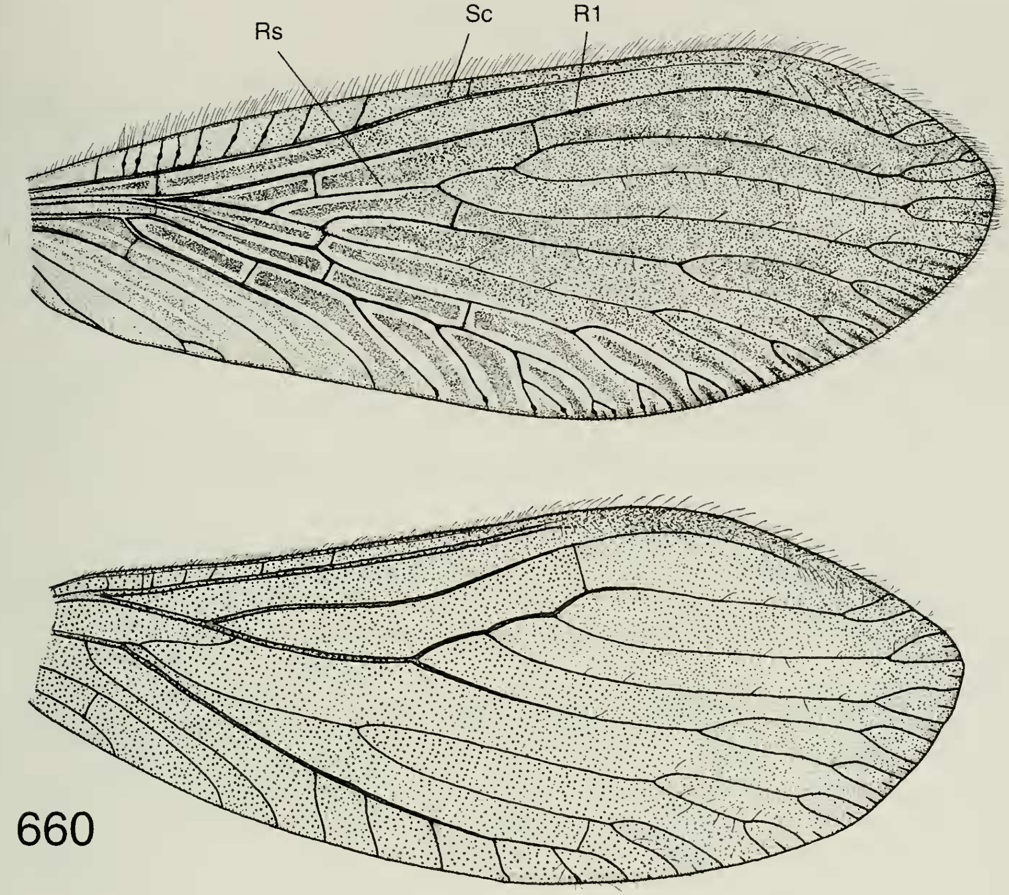
FIGURE 659. *Sisyra apicalis* Banks, habitus view. (Illustration by Artêmio Coelho da Silva)



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ACKNOWLEDGMENTS

The illustrations used in this publication were made by the late Fred Ehrman (Chrysopidae, Dilaridae, some Mantispidae, Myrmeleontidae, and Sisyridae), Virginia Kirsch (some Mantispidae, many Chrysopidae), Victoria Saxe (many Chrysopidae), Martin Meinander (Coniopterygidae), Victor J. Monserrat (most Hemerobiidae), Jere Schweikert (some Ascalaphidae, some Mantispidae, and Polystoechotidae), Linda Seabrooks Campbell (most Ascalaphidae, some Myrmeleontidae), Michelle Schwengel (some Myrmeleontidae), Artêmio Coelho da Silva (three habitus drawings), Zina Deretsky (*Psammoleon dunklei*), Diane Wong (some Chrysopidae) and others indicated with the individual drawings. No amount of credit is sufficient to acknowledge their contribution to this project.

Much credit must also be given to the Instituto de Biodiversidad in Costa Rica for supporting this and other biodiversity projects. The parataxonomists hired by the Instituto have devoted years of effort in remote field stations gathering much of the material used in this study. Equally important was their thoughtful regard to data. Each specimen bears detailed locality information, including elevational data, without which we would have little information about this important factor in such mountainous terrain.

A great many specimens were furnished by Wilfred Hanson and colleagues at Utah State University, Logan, Utah, U.S.A. This was due to a superb light trap collecting effort by Frank Parker over a number of years in the area near Cañas in Guanacaste Province and also involved a hard-working group of preparators at Logan. Additional specimens were donated by Joe Sheldon of Messiah College.

Costa Rican Chrysopidae could not have been described here without preparatory help from the late Phillip A. Adams. This family constitutes more than 40% of the species richness of Neuroptera within the country. The Neotropical green lacewings are a complex fauna which are difficult to study for historical reasons. Original descriptions of many species are very brief and uninformative, with almost no associated illustrations, and many of the types no longer exist. In addition, colors can fade away rapidly after death, particularly if specimens are killed or preserved with fluids. The most important suite of characters for identification are usually the male genitalia, which were never studied at the height of the descriptive age, i.e., in the first three decades of the 20th century. Dr. Adams spent 40 years studying descriptions, existing types, and long series of non-type specimens. He spent a great many hours carefully macerating, clearing, and staining the genitalia of specimens for identification and phylogenetic studies. As a result of these studies, he published much on the New World chrysopid fauna, using genital structures and fine illustrations for the first time. He described the genera and subgenera *Ceraeochrysa, Neosuarius,* and *Plesiochrysa* (Adams 1982a; 1982b; Adams and Penny 1987). Additionally, he redefined such genera as *Chrysopodes* on the basis of genitalic criteria. Without this preliminary work the present study would have been nearly impossible.

Brett C. Ratcliffe (University of Nebraska, Lincoln, Nebraska, U.S.A.) provided logistical support for the editor during an extended field trip to several major biomes of Costa Rica and participated in numerous stimulating discussions of the insect fauna of the country and its conservation.

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This project was conceived after discussion with Daniel H. Janzen and Winnie Hallwachs. Thereafter, they provided guidance and suggestions, hand delivering material for study and in other ways encouraging this effort. They provided the conceptual stimulation and framework for the biodiversity project in Costa Rica and secured much needed funding at its inception.

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